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GENERAL

ATOMIC POWER

3714 DL-16

Chalk River Project (Canada)

ECONOMIC ASPECTS OF NUCLEAR POWER. W. B. Lewis. Mar. 8, 1955. 10p. (AECL-165)

The present status of nuclear power technology in Canada is reviewed and economic factors affecting the development of nuclear power are discussed. The necessity for reducing the costs of processing radioactive materials and for reducing the cost of design and construction of reactors in making nuclear power economically feasible is stressed. (C.H.)

3715ATOMIC POWER FOR BRITAIN. UNITED KINGDOM'S TEN-YEAR PLAN. *Atomsics* 6, 93-9, 118(1955) Apr.

The possibilities of a large-scale use of atomic power in Britain are discussed. A proposed reactor-building program is outlined. Economic aspects are given special attention. (C.W.H.)

3716THE PRODUCTION OF ELECTRICAL POWER FROM SEPARATED FISSION-PRODUCTS. C. B. Amphlett (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 1, 173-80(1955) Feb.

A survey is made of the different methods described for producing electrical power from radioactive nuclides. The problem is examined in the light of nuclear physical and chemical considerations, and an evaluation is made of the potentialities of this method of producing power. (auth)

RESEARCH PROGRAMS

3717 NP-5588

Joint Establishment for Nuclear Energy Research (Norway) THIRD ANNUAL REPORT [FOR] 1953-54. 32p.

The work of JENER in 1953-54 is summarized including operation of JEEP, isotope production, reports, and finance. An experimental power reactor using heavy water and natural U in a pressurized system is being designed. The chemistry of U and Pu has been studied on a laboratory scale for purposes of designing a pilot plant capable of processing up to 10 tons of burned U rods a year, including the separation of Pu and the reprocessing of U metal. Examples are given of the projects in the Neutron Physics Department which include investigations of the fission cross section of U^{235} , the crystal structure of copper hydride by neutron diffraction, and the magnetic structure of magnetite by neutron scattering. Problems studied by the Reactor Physics Department include criticality of various reactor designs, shielding properties of concrete, effect of prompt and delayed γ emission on the reactivity of JEEP, and the rate of Pu production in heavy water reactors. (For preceding period see NP-5068.) (M.P.G.)

BIOLOGY AND MEDICINE

3718

MICROSPOROGENESIS IN EXCISED ANTHERS OF TRILLIUM ERECTUM GROWN ON STERILE MEDIA.

A. H. Sparrow, Virginia Pond, and Selma Kojan (Brookhaven National Lab., Upton, N. Y.). *Am. J. Botany* 42, 384-94(1955) Apr.**3719**

RADIOISOTOPE CONFERENCE, 1954. PROCEEDINGS OF THE SECOND CONFERENCE, OXFORD, 19-23 JULY.

VOL. I. MEDICAL AND PHYSIOLOGICAL APPLICATIONS. J. E. Johnston, R. A. Faires, and R. J. Millett, eds. London, Butterworths Scientific Publications, 1954. 418p.

Seventy papers emphasizing new ideas, new methods, and important new results obtained in studies using radioisotopes in therapy and diagnosis of disease, studies on animal physiology and pathology, the preparation of labeled compounds, and biochemical studies employing labeled compounds are presented. Discussions and literature citations are included. (C.H.)

AEROSOLS

3720 AD-33893

General Mills, Inc.

FINE GRINDING PROJECT. BI-MONTHLY PROGRESS REPORT [FOR] FEBRUARY 15 TO APRIL 15, 1954. REPORT NO. 1299. J. E. Barkley. Apr. 26, 1954. 169p. Contract DA-18-064-CML-2336.

Progress is reported in the development of methods for the size reduction of dry biological materials. Improved techniques for dispersing samples and for particle size analysis are described. (C.H.)

3721 USNRDL-TR-21

Naval Radiological Defense Lab.

A CONSTANT FLOW SUCTION UNIT FOR AEROSOL SAMPLING WORK. A. C. Schmidt and L. L. Wiltshire. Oct. 14, 1954. 23p.

This report describes a suction unit that will automatically maintain a constant flow of air through a filter sampler even though the drop in pressure across the filter varies over a wide range during the collection run. Two models are described, one having a fixed flow rate of 10 cfm, and the other being adjustable between 1 and 15 cfm. Both models will hold the flow constant to within 5% while compensating for any drops in pressure of up to 8 in. of Hg. A flow monitoring device is provided which shows whether the flow changes during a collection run and for how long. The flow control scheme uses only mechanical components so that the unit may be driven by either an electric motor or a gasoline engine. Components were selected for lightness and ability to withstand adverse operating conditions. (auth)

RADIATION EFFECTS**3722 AECU-3016**

National Research Council. Div. of Medical Sciences
SECOND CONFERENCE ON RADIATION CATARACTS AND NEUTRON EFFECTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION. ABSTRACTS OF PAPERS. Dec. 8, 1950. 34p.

Summaries and discussions on papers presented at this conference on radioinduced cataracts are presented. Topics discussed included radiation dosages producing cataracts; problems of individual and species susceptibilities; incidence of cataracts among atom bomb survivors; the effect of acute neutron exposures on the lens of young and adult dogs; the site of cataract formation; lens changes in rabbits after x irradiation; dosage and morphogenesis in x radiation cataracts of rabbits; a quantitative and morphologic study of radiation-induced cataracts; cataract induction in mice by slow neutrons and x rays; neutron absorbers in eye tissues; the effects of irradiation on lens metabolism; mechanisms for the conversion of radiation energy into tissue damage; mechanisms involved in the inhibition of mitosis by ionizing radiation; and a photographic technique for recording lens damage. (For preceding period see NP-1826.) (C.H.)

3723 AECU-3017

National Research Council. Div. of Medical Sciences
THIRD CONFERENCE ON RADIATION CATARACTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION. ABSTRACTS AND PROCEEDINGS. Jan. 28, 1952. 73p. (U-23920)

Summaries and discussions on papers presented at this conference on radioinduced cataracts are presented. Topics discussed include the pathogenesis of radiation cataracts; the effects of x rays on mitosis and nuclear fragmentation in the lens epithelium in normal and cysteine-treated mice; energetics of the eye; radiation effects on cement substance of the lens; ophthalmoscopic and microscopic appearance of cataractic changes in experimental animals; the relative effectiveness of neutrons and gamma rays; experimental radiation cataracts induced by neutrons; cataract studies made during Operation Greenhouse; follow-up studies with γ and neutron dosage in cataract formation; observations on cataracts in Japanese atomic bomb survivors; and radioinduced retinal damage and cataract formation in mice. (For preceding period see AECU-3016.) (C.H.)

3724 AECU-3018

National Research Council. Div. of Medical Sciences
FIFTH CONFERENCE ON RADIATION CATARACTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION. ABSTRACTS AND PROCEEDINGS. Mar. 26, 1954. 116p.

Summaries and discussions on papers presented at this conference on radioinduced cataracts are presented. Topics discussed include recent neutron dosimetry experiments; the present status of tissue-wall-tissue-gas dosimetry; various values of the RBE; effects of deuterons and α particles on the rabbits' lens; chronic neutron exposures in rats and mice; new experiments on radiation effects; studies on lens metabolism; radiation cataract studies; Operation Greenhouse studies on mice cataracts, iris atrophy, Harderian gland adenomas, and the relative effectiveness of cyclotron fast neutrons in cataract production in mice, rats, and guinea pigs; effects of cyclotron irradiations of mice and rabbits; the effect of radiation on amino

acids; radiation effects on the lachrymal gland; studies of Japanese cataracts in relation to shielding; and the current status of the cataract research program on monkeys. (For preceding period see AECU-3019.) (C.H.)

3725 AECU-3019

National Research Council. Div. of Medical Sciences
FOURTH CONFERENCE ON RADIATION CATARACTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION. ABSTRACTS AND PROCEEDINGS. Feb. 28, 1953. 93p.

Summaries and discussions on papers presented at this conference on radioinduced cataracts are presented. Topics discussed include radiation dosimetry for mixed beams of γ rays and neutrons; radiation exposure techniques; depth dosage curves in tissue for fast neutrons; chemical studies on the effects of x rays on the lens; effects of deuterons and γ particles on the rabbits' lens; follow-up studies on rabbits exposed to low doses of x rays and to cataractogenic doses of fast neutrons; the pathology of galactose cataracts; neutron-induced cataracts in dogs; the mechanism of lens injury in radiation cataracts; evolution of opacities in the lens of the rabbit; effect of neutron exposures fractionated over a period of five months; experiments on radiation cataracts; the incidence of lens opacities in mice exposed to x rays and thermal neutrons; radiation cataract investigations in England; radiation cataracts in Japan; current ophthalmological status of physicists exposed to neutrons; and the current status of the cataract research program on monkeys. (For preceding period see AECU-3017.) (C.H.)

3726 NM-001-059.13.04

Naval School of Aviation Medicine, Pensacola
THE RADIAL SPREAD OF THE TISSUE IONIZATION DOSAGE IN HEAVY NUCLEI TRACKS OF THE PRIMARY COSMIC RADIATION. Hermann J. Schaefer. Aug. 5, 1952. 31p. (ATI-169195)

Results of a detailed analysis of the ionization mechanism in tissue of heavy nuclei of primary cosmic radiation led to the conclusion that they differ greatly from all terrestrial radiations in the radial spread of the ionization dosage. As a numerical example the radial distribution of the ionization is computed for three characteristic energies of a heavy nucleus showing the changes in this distribution when the nucleus gradually loses energy. A heavy nucleus is also compared to an ordinary α particle of exactly equal specific ionization and the great difference in the spatial distribution of the ionization dosage in both cases is demonstrated. The possible radiobiological consequences of these findings are discussed briefly. (C.H.)

3727 NP-5584

School of Aviation Medicine
THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. EFFECT OF HIGH-INTENSITY X-RADIATION ON VELOCITY OF NERVE CONDUCTION. (Project No. 21-3501-0005, Report No. 18). Herbert B. Gerstner, John S. Orth, and Everett O. Richey. Oct. 1954. 12p.

Conduction velocity of isolated sciatic nerves was determined prior to and at 1, 2, and 4 hours following exposure to various doses of x radiation. In bullfrog nerves doses in excess of 75,000 r caused a decrease in conduction velocity; doses above 300 kr abolished nerve conduction within one hour following irradiation. Rabbit nerves had a higher radiosensitivity than frog nerves. Doses in excess of 45 kr caused complete block within one hour following exposure. (auth)

3728 NP-5586

Air Force Radiation Lab., Univ. of Chicago

THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. EFFECT OF WHOLE BODY X-IRRADIATION ON A NATURAL INHIBITOR OF CARBOXYPEPTIDASE. (School of Aviation Medicine Project No. 21-3501-0005, Report No. 9). Robert N. Feinstein and John C. Ballin. Air Force Radiation Lab. and Dept[s], of Biochemistry and Pharmacology, Univ. of Chicago. May 1954. 7p. Contract AF 33(038)27353.

Whole-body x irradiation of mice, rats, and rabbits at the LD₅₀ range increases the activity of certain tissue cathepsins. Liver, kidney, and intestine were the tissues tested, and it was found that one of three liver cathepsins, two of the same three cathepsins in kidney, and two of the three in intestine were increased in activity by the radiation. This appears due, at least in the case of kidney carboxypeptidase, to the destruction by the x-rays of an enzyme inhibitor. It is possible that the source of all inhibitor found in tissues and blood alike is the blood cell, probably the leukocyte. Hydrogen peroxide behaves radio-mimetically in this respect, since intraperitoneal injection of H₂O₂ into rats or rabbits causes similar, though faster, changes in kidney and blood cell inhibitor. The possibility is suggested that the reduction of carboxypeptidase inhibitor in blood cells may serve as a basis for determining, within 24 hours of the exposure, whether or not an individual has received a lethal dose of ionizing radiation. (auth)

3729 NP-5587

Air Force Radiation Lab., Univ. of Chicago

BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. ACETYLATION OF SULFANILAMIDE BY X-IRRADIATED ANIMALS. (School of Aviation Medicine Project No. 21-3501-0005, Report No. 21). Kenneth P. DuBois, Gladys J. Cotter, and Donald F. Petersen. Air Force Radiation Lab. and Dept. of Pharmacology, Univ. of Chicago. Dec. 1954. 6p. Contract AF 33(038) 27353.

The influence of x irradiation on the ability of animals to acetylate sulfanilamide was investigated by administering daily doses of the drug to irradiated rats and guinea pigs and measuring the urinary excretion of free and acetylated sulfanilamide. Measurements for 6 days after 400, 600, and 800 r of x ray indicated that the acetylation of sulfanilamide by rats was not affected after these doses of radiation. Other measurements on rats receiving 1,200 r indicated no impairment of this acetylation reaction during the survival time. After 400 and 800 r no impairment of the acetylation of sulfanilamide by guinea pigs was noted. It is, therefore, concluded that x irradiation does not cause inactivation of the coenzyme A of the liver in vivo. Measurements of the blood levels of sulfanilamide at frequent intervals after administration of the drug indicated no difference in the rate of absorption or duration of retention of this drug in irradiated and normal rats. (auth)

3730 UCRL-2881

Radiation Lab., Univ. of Calif., Berkeley

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1954. Feb. 28, 1955. 46p. Contract W-7405-eng-48.

Results are reported from tracer studies in the rat employing either carrier-free or high-specific-activity radioisotopes of La, Pm, Gd, Tb, and Er. Data are tabulated from a series of tracer studies on the bone deposition

of Ca⁴⁵ and Sr⁸⁹-Y⁸⁹ mixture in rats and monkeys. In the skeletons of rats sacrificed from 4 to 265 days after injection the Sr⁸⁹-Ca⁴⁵ ratios were consistently less than unity and averaged approximately 0.65. A method is described for mounting uniform samples for radiometric analysis of α and soft- β emitters dissolved in salt solution. Propylthiouracil treatment increased the thyroidal accumulation of At²¹¹ in rats and the combination of this treatment with thyroxine and propylthiouracil decreased the thyroidal uptake of At²¹¹. Preliminary results are discussed on the pathological effects of At²¹¹ on rats and monkeys. Preliminary results are reported in the *in vivo* determination of two isotopes simultaneously; human blood volume studies with Cr⁵¹-labeled red cells; the relationship of age and sex to the early mixing of Na²⁴ in humans; the incorporation of P³² into the desoxyribonucleic acid (DNA) of hypophysectomized rats; the total DNA content of livers and small intestine after whole-body x irradiation of mice; the relationship between serum lipoproteins, coronary atherosclerosis, and coronary disease; and early cardiovascular disturbances following thermal injury. (For preceding period see UCRL-2823.) (C.H.)

3731 AEC-tr-2108

THE EFFECT OF THE LENGTH OF X-RAY WAVES ON THE FREQUENCY OF VISIBLE MUTATIONS IN DROSOPHILA MELANOGASTER. M. E. Neuhaus and J. L. Schechtmann. Translated from *Biol. Zhur.* 4, 923-8 (1935). 12p.

3732

EFFECT OF X-RAYS AND HORMONES ON RESORPTION RATE OF INJECTED NaH¹⁴CO₃. Arne G. Forssberg and George Hevesy (Univ. of Stockholm, Sweden). *Am. J. Physiol.* 180, 325-30 (1955) Feb.

3733

BIOCHEMICAL EFFECTS OF RADIATION. Kenneth P. DuBois and Donald F. Petersen (U. S. Air Force Radiation Lab., Chicago). *Ann. Rev. Nuclear Sci.* 4, 351-76 (1954).

This review deals primarily with the actions of ionizing radiations on enzyme systems, particularly with the alteration of enzyme reactions by high-energy radiations. 192 references. (L.M.T.)

3734

VERTEBRATE RADIobiology (LETHAL ACTIONS AND ASSOCIATED EFFECTS). John F. Thomson (Argonne National Lab., Lemont, Ill.). *Ann. Rev. Nuclear Sci.* 4, 377-400 (1954).

Although the lethal actions of ionizing radiations on vertebrates have not heretofore been discussed under such a specific title in *Ann. Rev. Nuclear Sci.*, various aspects of the subject have recently been surveyed by various authors. In addition, some 2100 abstracts of papers in radiobiology prior to 1952 were recently assembled in convenient form (ANL-5111(1953)). Hence, primary emphasis is placed here on recent work concerned with radiation toxicology, modification of lethal effects, and mechanisms of lethal action. (auth)

3735

EXTENDING ONION STORAGE LIFE BY GAMMA IRRADIATION. S. L. Dallyn (Long Island Vegetable Research Farm, Riverhead, N. Y.) and R. L. Sawyer and A. H. Sparrow (Brookhaven National Lab., Upton, N. Y.). *Nucleonics* 13, No. 4, 48-9 (1955) Apr.

White and yellow strains of the Sweet Spanish variety

of onions were exposed to dosages of 1000, 2000, 4000, and 8000 r for 24 hr. All irradiated bulbs plus a check were then placed under two storage conditions; (a) temperature, 60 to 65°F, R. H., 30 to 40%; and (b) temperature 50 to 55°F, R. H. 70 to 80%. A table of data shows the percent of bulbs in each sample which showed sprout growth. (L.M.T.)

3736

EFFECTS OF DELAYED OVIPOSITION ON X-RAY-INDUCED STERILITY. Leo LaChance (North Carolina State Coll., Raleigh). *Nucleonics* 13, No. 4, 49-50 (1955) Apr.

The effect of delaying the period of observation on induced sterility was investigated from x-irradiation studies on the parasitic wasp Habrobracon. (L.M.T.)

3737

INACTIVATION OF MEF1 POLIOMYELITIS VIRUS BY IONIZING RADIATION. Ernest C. Pollard and Lisbeth M. Kraft (Yale Univ., New Haven, Conn.). *Proc. Soc. Exptl. Biol. Med.* 88, 331-3 (1955) Mar.

Poliomyelitis virus was bombarded by deuterons and alpha particles. The inactivation of infectivity corresponds to a cross section of $7.1 \pm 3.5 \times 10^{-12} \text{ cm}^2$ for alpha particles and $6.0 \pm 5.3 \times 10^{-12} \text{ cm}^2$ for deuterons. The radius of an assumed spherical sensitive volume so deduced is $15.7 \pm 4.8 \text{ mg}$. (auth)

3738

BIOCHEMICAL CHANGES IN SPLEENS OF RATS AFTER LOCALIZED X-IRRADIATION. Donald F. Petersen, Frank W. Fitch, and Kenneth P. DuBois (Univ. of Chicago). *Proc. Soc. Exptl. Biol. Med.* 88, 394-7 (1955) Mar.

Measurements of the adenosine triphosphatase activity, the 5-nucleotidase activity, the desoxyribonucleic acid concentration, citric acid synthesis and the histologic appearance of the spleens of rats given 800 r of whole-body x irradiation and the same dose of x ray to the exteriorized spleens with the remainder of the body shielded were made. Shielding the body during irradiation of spleen prevented the large increases in the activity of phosphatases which occur in the spleen after whole-body irradiation. Prevention of the inhibitory effect of x ray on citrate synthesis and a much smaller decrease in desoxyribonucleic acid content of the spleen as well as less severe histologic changes were observed in the spleens of body-shielded rats. The results of this study indicate that x ray does not exert a direct effect on the enzymes involved in the biochemical reactions which were studied. (auth)

3739

STIMULATION OF ERYTHROPOEISIS IN IRRADIATED DOGS AND RATS. Frederick Stohlman, Jr., E. P. Cronkite, and G. Brecher (National Inst. of Arthritis and Metabolic Diseases, National Insts. of Health, and Naval Medical Research Inst., Bethesda, Md.). *Proc. Soc. Exptl. Biol. Med.* 88, 402-6 (1955) Mar.

Following whole-body exposure to sublethal doses of x rays, erythropoiesis was depressed in both dogs and rats, but could be markedly increased by bleeding the animals shortly before or after irradiation. In rats, post-irradiation administration of PAPP resulted in a similar increase in erythropoiesis. Blood loss 24 hours after irradiation had no appreciable effect. The data indicate

the reversibility or modification of injury to the erythropoietic system without similarly affecting the recovery of other bone marrow elements. (auth)

3740

EFFECT OF WHOLE-BODY X-IRRADIATION ON CONCENTRATIONS OF DPN AND DPNH IN RAT LIVER. Herbert J. Eichel and M. A. Spirtes (Hahnemann Medical Coll., Philadelphia). *Proc. Soc. Exptl. Biol. Med.* 88, 412-14 (1955) Mar.

X irradiation of intact rats with 700 r had little effect on the concentrations of oxidized and reduced DPN of liver, while a dose of 980 r lowered the level of reduced DNP by 15 to 32% without significantly altering the amount of oxidized coenzyme. Possible explanations for these results have been discussed. (auth)

3741

HYDRATION AND RADIOSENSITIVITY. Roberts Rugh and Helen Clugston (Marine Biological Lab., Woods Hole, Mass. and Columbia Univ., New York). *Proc. Soc. Exptl. Biol. Med.* 88, 467-72 (1955) Mar.

Artemia, essentially in the blastula stage in suspended development, can tolerate about 200,000 r more x radiation in the dry than in the wet state, if criteria of hatching and motility after 48 hours hydration are considered. The disparity between hatching and motility curves is greater in dry than in hydrated eggs following x irradiation. Requirements for hatching must be less radiosensitive than those for motility, since there was always a disparity between these 2 steps in development. It is probable that hydrated eggs are so radiosensitive that only the hardest survive, and these reach motility. Hydrated eggs are variously radiosensitive, depending upon duration of hydration prior to x irradiation. There is an immediate drop in radioresistance following hydration, with gradual recovery of this resistance so that after 7 hours of hydration eggs are quite radioresistant again. Delay of one month between x irradiation and hydration was detrimental to eggs, resulting in reduced values for hatching and motility. The greatest disparity was at 300,000 r. (auth)

3742

DIFFUSION OF FLUIDS IN SKIN AFTER EXPOSURE TO X-IRRADIATION. G. Prodi and R. Miceli (Center of Bologna for Cancer Research, Italy). *Proc. Soc. Exptl. Biol. Med.* 88, 472-5 (1955) Mar.

India ink and diphtheria toxin were injected intradermally in the rabbit, in previously x-irradiated and unirradiated skin areas, the latter being symmetrically opposite to the former. In the irradiated areas the spreading surface of the injected materials was larger than in control areas. It is assumed that the increase of diffusion is due to depolymerization of the mucopolysaccharides of the ground substance by x irradiation. (auth)

3743

THE INFLUENCE OF PRETREATMENTS AND POST-TREATMENTS ON BACTERIAL INACTIVATION BY IONIZING RADIATIONS. George E. Stapleton (Oak Ridge National Lab., Tenn.). *Ann. N. Y. Acad. Sci.* 59, 604-18 (1955) Feb.

3744

EFFECTS OF COMBINED WHOLE BODY ROENTGEN IRRADIATION AND HIGH EXPLOSIVE BLAST INJURY IN MICE. Carl-Johan Clemesson and Arne Nelson (Research Inst. of

National Defence, Sundbyberg, Sweden). Acta Radiol. 43, 161-72 (1955) Feb.

Groups of mice were exposed both to roentgen irradiation and high explosive blast. With the body weight curves and number of survivals as a criterion of the effect, no significant increase of the effect of the combination of the two exposures as compared with the influence of blast or irradiation alone could be observed, except in the group exposed to the highest blast pressure and radiation dose. Contrary to what could be expected in some of the irradiated groups exposed to the highest blast pressures, an accelerated increase in body weight was observed after about two weeks. (auth)

3745

ATOMIC BOMB INJURIES. Nobuo Kusano, ed. Tokyo, Tsukiji Shokan Co., 1953. 112p.

Summaries of many studies and reports by Japanese scientists on the effects of the atomic explosions on residents of Nagasaki and Hiroshima are supplemented by 112 illustrations. (C.H.)

RADIATION HAZARDS AND PROTECTION

3746 RDB(W)/TN-58

Research and Development Branch, Industrial Group, Windscale Works, United Kingdom Atomic Energy Authority, Windscale, Cumb. (England)

AN ANTHOLOGY OF HEALTH PHYSICS DATA. (SECOND EDITION). H. J. Dunster. Oct. 1954. 53p.

The report comprises a personal collection of data which have been found repeatedly useful in work on the problems of radiation protection. (auth)

3747

EFFECT OF CHLORPROMAZINE ON SURVIVAL TIME IN IRRADIATED MICE. Thomas J. Haley, W. G. McCormick, and Eve F. McCulloch (Univ. of California, Los Angeles). Proc. Soc. Exptl. Biol. Med. 88, 475-7 (1955) Mar.

Premedication with 5 mg/kg of chlorpromazine intraperitoneally significantly increased the mean survival time in irradiated mice. Post-irradiation medication with this dose of drug was neither beneficial nor detrimental but doses of 10 and 20 mg/kg decreased survival time by acting synergistically with the irradiation. The sensitivity of the irradiated animals to medication is discussed. (auth)

RADIOTHERAPY

3748 ACRH-2

Argonne Cancer Research Hospital

SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. Sept. 1954. 170p. Contract AT(11-1)-69.

An investigation of the physical properties of Cs¹³¹ revealed that the production of this isotope at curie level is feasible and that the characteristic 30-kv fluorescent x radiation emitted by Cs¹³¹ during its decay by electron capture offers definite advantages for radiation implant therapy. Clinical studies, in which C¹⁴ and tritium were used as tracers, are summarized. In mice of strains that normally resist transferred leukemia, sublethal exposures to x radiation overcame the regulatory forces of the host and death ensued. Advantage was taken of this finding to study the role of the spleen in resisting the successful proliferation of injected leukemic cells. Preliminary results are re-

ported on studies of the preparation, localization, and effects of antitumor antibodies in experimental animals and on studies on the effect of intravenous injection of plasma from x-irradiated, spleen-shielded rats on erythropoiesis in normal rats as measured by the red cell uptake of Fe⁵⁹. From results of an investigation on the nature of the splenic agent responsible for survival of mice after lethal exposures to x radiation it was concluded that the agent is not a desoxyribonucleoprotein. Summaries of papers submitted for publication are included. (For preceding period see ACRH-1.) (C.H.)

3749

THYROTOXIC MYOPATHY AND MYASTHENIA GRAVIS. A CASE REPORT. Raghunath Prasad and J. Elliot Levi (Sinai Hospital, Baltimore). J. Clin. Endocrinol. and Metabolism 15, 476-80 (1955) Apr.

A case is reported of simultaneous hyperthyroidism, thyrotoxic myopathy, and myasthenia gravis. Radioiodine therapy produced a remission of the hyperthyroidism and thyrotoxic myopathy but had no effect on the myasthenia gravis. (auth)

3750

BLOOD-DROP DETERMINATION OF Au¹⁹⁸ IN PROSTATE THERAPY. Wayne M. Rounds and Titus C. Evans (State Univ. of Iowa, Iowa City). Nucleonics 13, No. 4, 52-4 (1955) Apr.

Blood drops of ~1 cm² area chosen at approximately 15-sec intervals are counted using a mica-end-window tube. Drops are collected by rotating large-size filter papers under a needle inserted in the forearm. Time can be coordinated with interval marks on a recording tape, with the resulting curve reflecting rapid changes of Au¹⁹⁸ and accurate for blood levels encountered during prostatic Au¹⁹⁸ injection. (L.M.T.)

TRACER APPLICATIONS

3751 AECU-3014

Michigan State Coll. of Agriculture and Applied Science NUTRITION OF THE STRAWBERRY (FRAGARIA SPP.) WITH SPECIAL REFERENCE TO FOLIAR ABSORPTION OF RADIOPHOSPHORUS AND CALCIUM (thesis). Robert Alan Norton. 1954. 147p. Contract [AT(11-1)-159].

3752 HW-35174

Hanford Works

THE UPTAKE AND TRANSLOCATION OF CESIUM BY PLANTS. J. H. Rediske and A. A. Selders. Sept. 15, 1953. 20p. Contract W-31-109-Eng-52.

In Red Kidney bean plants grown at a pH of 6.0 in nutrient culture, there was no significant redistribution of cesium from the older leaves, whereas the younger leaves demonstrated retranslocation where concentration gradients existed. The concentration of cesium in the aerial portions of the plant is nearly proportional to the concentration of cesium added to the nutrient solution. The absorption of cesium tends to increase as the pH of the nutrient environment is decreased. Uptake efficiency for cesium with bean plants was 0.68, tomato 0.32, Russian thistle 0.05 and wheat 0.02. Barley plants can attain a concentration of cesium in the leaves only 0.13 times the concentration in an Ephrata fine sandy loam soil. (auth)

3753 UCLA-328

Atomic Energy Project, Univ. of Calif., Los Angeles THE EFFECT OF CERTAIN ENVIRONMENTAL FACTORS

ON MINERAL UPTAKE BY BEAN PLANTS: I. PHOSPHORUS UPTAKE. William L. Ehrler, Arthur H. Lange, and Karl C. Hamner. Mar. 25, 1955. 38p. Contract AT-04-1-GEN-12.

To study phosphorus uptake under controlled environmental conditions, an experimental area was constructed that had the following major environmental factors under partial or complete control: light, air temperature, relative humidity, mineral nutrient balance, pH, root temperature, and root aeration. The effect of short-time variations in certain of these major environmental factors on the uptake of phosphorus was studied by accurately analyzing the tops of bean plants for their content of radiophosphorus. The amount of stable phosphorus, calculated from specific activity relationships, absorbed by the roots and translocated to the shoots constituted an index of the relative effects of various environmental variables which were manipulated only one at a time, with the other factors held constant. Using this technique, the amount of phosphorus uptake was determined for an absorption period of only twenty-four hours to prevent any effects on uptake that a changed rate of growth might induce over a longer period of absorption. Results are summarized. (auth)

3754

THE METABOLISM OF 132 TELLURIUM-IODINE MIXTURE IN MAMMALS. D. W. H. Barnes, G. B. Cook, G. E. Harrison, J. F. Loutit, and W. H. A. Raymond. *J. Nuclear Energy* 1, 218-30(1955) Feb.

$\text{Te}^{132}-\text{I}^{132}$ has been given in 0.1N acid orally to guinea pigs and rats. The absorption from the gut is greater in the rat. The rat also retains more tellurium, in virtue of its concentration in the blood. In the rat, but not in the guinea pig, rabbit, or mouse, the red corpuscles take up tellurium and bind it to intracorporeal protein, presumably hemoglobin. Thus tellurium may provide a useful marker for the red cells in physiological studies on the rat. (auth)

CHEMISTRY

3755 AERE-C/M-220

Atomic Energy Research Establishment, Harwell, Berks (England)

THE PREPARATION OF A QUANTITY OF ALUMINIUM PHOSPHIDE. E. Hesford, F. Hudswell, R. B. Andrews, and J. A. Winter. Oct. 26, 1954. 7p.

A modified method for the preparation of aluminum phosphide is presented. The product is adequate for neutron diffraction studies. (C.W.H.)

3756 CCC-1024-TR-96

Oklahoma Univ.

ULTRAVIOLET AND INFRARED ABSORPTION SPECTRA OF ORGANOBOBORON COMPOUNDS. P. L. Pickard, C. L. Dulaney, and G. W. Polly. Feb. 18, 1955. 13p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

The infrared spectra of seven trialkylboranes were measured, and the characteristic absorption bands in the region 799 to 1470 cm^{-1} were recorded. An attempt was made to develop an analytical method using the absorption in the ultraviolet region. Amine-boron trifluoride complexes, boranes, pyridine-borane complexes, hydroxyboranes, and amine-boric acid complexes were run, as well as solutions of boric acid and diols mixed with

amines or hydroquinone. All of the experiments were unsuccessful from the standpoint of a practical analytical method. (auth)

3757 MLM-909

Mound Lab.

A MODIFIED JOLIOT APPARATUS FOR THE STUDY OF ELECTRODEPOSITION OF POLONIUM. (INFORMATION REPORT). W. H. Power. Oct. 28, 1953. 16p. Contract AT 33-1-Gen-53.

A modified Joliot apparatus for continuously recording ionization current in the vicinity of an alpha-transparent electrode has been used to study the deposition of polonium from hydrochloric acid solution. The cathode potential was changed at a uniform rate by varying the grid potential of one stage of a difference amplifier by a motor-driven slide wire. Anode control was attained by adding a phase inverter between the amplifier and the current-control units. Critical deposition or dissolution potentials were determined by increases or decreases in the rate of change of ionization current with potential. The reversibility of electrode potentials was determined by alternately making cathodic and anodic sweeps. For reversible systems, the cathodic inflections occurred at the same potentials as the anodic inflections. Ionization current inflections at 0.64, 0.56, 0.44, and 0.34 volt to the standard hydrogen electrode were detected when 10^{-6} to 10^{-4} molar polonium solutions were electrolyzed in 4.7 normal hydrochloric acid solution. This variety of reduction potentials indicates that polonium has several oxidation states in solutions of hydrochloric acid. The precision of the method was not sufficient to allow calculation of the oxidation state of polonium in solution from the change in electrode potential with change of polonium concentration. The precision could probably be improved if a truly inert conductor could be used for electrode material. Both gold and platinum are suspected of forming alloys with polonium. (auth)

3758 NP-5580

Stanford Research Inst.

DETERMINATION OF THE MECHANISM OF THE INCREASE OF VISCOSITY OR ORGANOSILICON COMPOUNDS AT HIGH TEMPERATURES. REPORT NO. 38. QUARTERLY PROGRESS REPORT [FOR] DECEMBER 31, 1954 TO MARCH 15, 1955. E. E. Ryskiewicz. 10p. Contract AF 33(616)-168.

The effect of antioxidants on the oxidation of tetrapentoxysilanes was studied using tetra (2-pentoxy) silane as a model compound. Under the conditions used, no oxygen uptake was observed in the presence of Ionol, diphenylamine, and phenothiazine. In order to determine the extent of effective antioxidant action under these conditions a long-term run is being carried out using Ionol in a 0.1% concentration. The hydrolysis and gelling of tetra (2-pentoxy) silane were found to be markedly affected by di-tert-butyl peroxide and to a lesser extent by formic acid and tert-butyl hydroperoxide. The hydrolysis of tetra (2-pentoxy) silane is being studied in a heterogeneous system in an attempt to explain the differences between the oxidation and hydrolysis runs in time of gelling. (For preceding paper see NP-5563.) (auth)

3759 NP-5581

Colorado Univ.

ENERGY DISTRIBUTION IN LUMINESCENCE SPECTRA OF ORGANIC COMPOUNDS. FINAL REPORT [FOR]

SEPTEMBER 1, 1952–NOVEMBER 30, 1954. Frank E. E. Germann. Nov. 30, 1954. 123p. Contract N6-ONR-231-T.O.12.

A new system for the detection of infrared radiation (7,000 Å to 20,000 Å) has been built. This uses a lead sulfide photoconductive cell and a high gain AC amplifier. An integrating circuit is used to reduce the noise, in particular photocell noise. Infrared lines of helium and mercury, up to the helium line of 20,581 Å have been detected. The peak response of the system is at about 18,000 Å. Using this new detector, infrared phosphorescence of a number of different substances has been studied. Phosphorescent emission has been found for a series of cadmium sulfide-zinc sulfide phosphors up to a wavelength of 9,000 Å. The long wavelength end of the emission curve as well as the maximum are shifted towards longer wavelength with increasing cadmium sulfide content. Investigations on the phenomenon of energy transfer in phosphor systems have been carried out with the use of high energy sources for excitation and with the use of some type of photomultiplier tube device for the detection of the emission. Ordinary spectrographic procedures have been employed. The fluorescence spectra of solutions of various organic compounds have been determined. The data were taken on solutions of one and two solutes over a range of concentrations so that the phenomenon of energy transfer could be thoroughly studied. An attempt was also made to study the effect of ortho substitution upon the fluorescence spectra of a series of diphenyl compounds. The analysis of the results in connection with the phenomenon of energy transfer leads to the following conclusions. In the phosphor system investigated, the energy which ultimately appears as an enhancement of the emission of one of the solutes has as its origin that energy which is absorbed by the solvent from the ultra violet source employed in the investigation. This energy is transferred by some mechanism involving the second solute of this system to the solute whose emission is then enhanced. The data seem to indicate also that mechanism of transfer does not involve the emission of light energy by one solute and the subsequent absorption and re-emission of that energy by the second solute. (auth)

3760 RDB(W)/TN-136

Research and Development Branch, Industrial Group, Windscale Works, Dept. of Atomic Energy, Windscale, Cumb. (England)

THE FABRICATION OF PLASTICS. THE WELDING OF POLYTHENE. A REPORT OF PROGRESS FROM JANUARY 1, 1953 TO NOVEMBER 1, 1953. M. G. Hipkins and P. F. Joy. May 1954. 37p.

Welding techniques for polythene which give at least 85% of the strength of the unwelded material are described. It has been established that the failure of welded or unwelded polythene sheet and tube under tensile or bending stress is invariably associated with small internal flaws such as air bubbles or lack of fusion. A limited amount of work on nondestructive testing methods which may be capable of detecting small internal flaws has been carried out. (auth)

3761 AD-45886

PHOTO-ELECTROMOTIVE FORCES IN CUPROUS OXIDE. (Fotoelektrodvizhushchie Sily V Zakisi Medi). V. E. Lashkarev and K. M. Kosonogoya. Translated by David Kraus from Zhur. Ekspl't. i Teoret. Fiz. 18, 927-36 (1948). 18p.

It is shown that the sign of the photo-electromotive force is fully determined by the conditions at the metal-semiconductor junction. The spectral distribution of the positive and the negative photo-electromotive forces in cuprous oxide is investigated. An interpretation of the observed differences is given. (auth)

3762 AEC-tr-2111

ON ACIDS AND BASES. M. Usanovich. Translated from Zhur. Obshchey Khim. 9, 182-92 (1939). 29p.

A theory of acid and bases is presented. In it, acids are defined as substances which are capable of detaching cations and combining with anions. An outstanding point stated is that the acid and base functions depend on the coordination nonsaturation of the atoms (ions) which enter into the structure of the given compound. (C.W.H.)

3763 AEC-tr-2116

EQUILIBRIUM IN THE REDUCTION OF SILVER CHLORIDE BY HYDROGEN. Fusao Ishikawa and Motoo Watanabe. Translated from Bull. Inst. Phys. Chem. Research Tokyo 8, 552-61 (1929). 11p. Available from Associated Technical Services (Trans. 14G5J), East Orange, N. J.

Equilibrium studies were made of the system 2AgCl (liq.) + H_2 = 2Ag (s) + 2HCl at 456 to 710°C by means of the static method. The relationship between the equilibrium constant and temperature, as well as the free energy of this reaction, was determined. A similar study was made on the equilibrium 2AgCl (s) + H_2 = 2Ag (s) + 2HCl at 383 to 417°C. (auth)

3764 AEC-tr-2117

A CONSIDERATION OF THE MECHANISM OF REDUCTION OF SILVER CHLORIDE BY HYDROGEN AND DEUTERIUM ON THE BASIS OF THE ABSOLUTE REACTION RATE. Izumi Higuchi. Translated from Bull. Inst. Phys. Chem. Research Tokyo 21, 843-8 (1942). 8p. Available from Associated Technical Services (Trans. 16G5J), East Orange, N. J.

The mechanism of reduction of silver chloride by hydrogen (or deuterium) was investigated on the basis of the theory of absolute reaction rates. By comparison with experimental results, a plausible mechanism was proposed. The agreement between theory and experiment was satisfactory; although the data for calculation are inaccurate, the order of magnitude rather than the numerical values is significant. (auth)

3765 AEC-tr-2118

THE RATE OF REDUCTION OF SILVER CHLORIDE BY HYDROGEN AND DEUTERIUM. Fusao Ishikawa and Kiyoshi Yoshimura. Translated from Bull. Inst. Phys. Chem. Research Tokyo 20, 201-8 (1941). 9p. Available from Associated Technical Service (Trans. 15G5J), East Orange, N. J.

The velocities of the heterogeneous reaction $\text{H}_2(\text{D}_2) + 2\text{AgCl} = 2\text{Ag} + 2\text{H}(\text{D})\text{Cl}$ were measured at 370 to 440°C in the presence of excess silver chloride by measuring the pressure changes at constant volume. The reaction velocity could be expressed by the following equation, $-\frac{dp_{\text{H}_2}}{dt} = k p_{\text{H}_2}/1 + B p_{\text{HCl}}$. In this reaction hydrogen or deuterium was adsorbed by silver chloride, and the produced hydrogen chloride or deuterium chloride, which was adsorbed still more tenaciously on silver chloride than hydrogen or deuterium, interfered with the reactions. The difference between the apparent energies of activation, amounting to 4.1 kcal, which was calculated from the temperature coefficient of the velocity constant, was related to the unknown

heats of adsorption of the various gases on silver chloride and was affected markedly by the inevitable experimental errors. Although the value of 4.1 kcal was much greater than the difference between the zero-point energies of the hydrogen and deuterium molecules, it may be assumed that the difference between the rates of reactions of solid silver chloride with hydrogen and with deuterium was due mainly to the difference between the zero-point energies of the hydrogen and deuterium molecules. (auth)

3766 AERE-Lib/Trans-456

THE ADSORPTION OF SALTS AT THE SURFACES OF METALS. H. von Euler and G. Zimmerlund. Translated by F. Hudswell from Arkiv Kemi Mineral. Geol. 8, 1-23(1921). 15p.

3767

KINETICS OF ISOTOPIC EXCHANGE; ISOTOPIC EX-
CHANGE UNDER DYNAMIC CONDITIONS. S. Z. Roginskii
(Academy of Science, S.S.R.). Doklady Akad. Nauk
S.S.R. 100, 939-42(1955) Feb. 11. (In Russian)

3768

THERMODYNAMIC PROPERTIES OF MAGNESIUM CHLORIDE IN MELTS OF $MgCl_2$ -LiCl, $MgCl_2$ -NaCl, $MgCl_2$ -KCl, $MgCl_2$ -RbCl. B. F. Markov, Yu. K. Delimarskii, and I. D. Panchenko. (Inst. of General and Inorganic Chemistry, Kiev). Zhur. Fiz. Khim. 29, 51-61(1955) Jan. (In Russian)

3769

ON ION EXCHANGE EQUILIBRIA. III. AN INVESTIGATION OF SOME EMPIRICAL EQUATIONS. Erik Högfeldt (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 9, No. 1, 151-65(1955).

Empirical equations by the following authors for representing ion exchange equilibria are discussed: Kroeker, Vageler, Weisz, Boedeker, "Freundlich," Wiegner-Jenny, van Dranen, and Rothmund-Kornfeld. Also an empirical equation recently given by Yamabe and Sato is discussed in a note. Discussion is limited to exchange between monovalent ions except when discussing the Rothmund-Kornfeld equation. It is shown that the linear plots used for determining the constants in the empirical equations are too insensitive to be used for testing the applicability of the equation under consideration. A more sensitive plot is obtained if the constants in the empirical equation are used for calculating the equilibrium quotient curve $\kappa(\beta)$. There are three different kinds of equilibrium quotient curves recorded in literature: falling, rising, and curves with maximum or minimum. No empirical equation except the one of "Freundlich" is capable of representing all of these types. The most useful equation seems to be that of Rothmund and Kornfeld which can be extended in a very simple manner to all three types of equilibrium quotient curves. In connection with this equation some different methods for finding an approximate value of the thermodynamic equilibrium constant are discussed, and it is shown that k^1/p (where k and p are the empirical constants in the Rothmund-Kornfeld equation) and $\kappa_{B,A}(\beta=0.5)$ may be useful first approximations to the thermodynamic equilibrium constant. (auth)

3770

EXCHANGE OF RADIOIRIDIUM BETWEEN HEXA-CHLOROIRIDATE(III) AND HEXACHLOROIRIDATE(IV) IONS. Eric N. Sloth (Argonne National Lab., Lemont, Ill.) and Clifford S. Garner (Univ. of California, Los Angeles). J. Am. Chem. Soc. 77, 1440-4(1955) Mar. 20.

Exchange of radioiridium between $IrCl_6^{2-}$ and $IrCl_6^{3-}$ ions in 1 f hydrochloric acid at complex ion concentrations ranging from 0.1 to 0.0001 f has been found to be complete in exchange times of the order of one minute at 1 and 50° in the dark. Although the same results were obtained with three different chemical separation methods, the possibility of an induced exchange cannot be excluded. If it be assumed that the exchange is not separation-induced and that a rate law first order in each of the reactant iridium complexes is followed, the specific rate at 1° is greater than 290 liter mole⁻¹ sec⁻¹. Precautions in the isotopic labeling of substitution-inert complexes are discussed. (auth)

3771

MISCIBILITY OF LIQUID METALS WITH SALTS. II. THE POTASSIUM-POTASSIUM FLUORIDE AND CESIUM-CESIUM HALIDE SYSTEMS. M. A. Bredig, H. R. Bronstein, and Wm. T. Smith, Jr. (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 1454-8(1955) Mar. 20.

Miscibility in all proportions of cesium metal with cesium halides at and above the melting points of the pure salts, and of potassium metal with potassium fluoride fifty degrees above the melting point of the salt was found. Vapor pressure measurements on some of these mixtures confirmed their true solution nature. The temperature-concentration range of coexistence of two liquid phases decreases in going from sodium to potassium systems and disappears altogether for the cesium systems. The solubility of the solid halides in the corresponding liquid alkali metals, at a given temperature, increases greatly with increase of atomic number of the metal. This may be explained by the decrease of cohesive forces in both the metal and its salts as the atomic number of the metal is increased. Partial heats of solution of the solid salts, at saturation, in the liquid metals, also correlate well with the cohesive energies, or heats of vaporization and sublimation, ΔH_v and ΔH_s , of the liquid metals and the solid salts, respectively: CsF, with its low heats of solution and sublimation, 10 and 37 kcal., represents one extreme case. NaF, with the values 26 and 61 kcal., respectively, represents another extreme case, the high values resulting from the small size of both Na^+ and F^- . The low heat values for CsF may be connected with the polarization of the large Cs^+ by the small F^- . The heat of solution of sodium halides in sodium metal increases from the chloride (20 kcal.) to the iodide (28 kcal.), even though the heat of sublimation of the salt decreases from 48 to 43 kcal. More energy should be required to "substitute" anions of increasing size for electrons in a metal of comparatively high cohesive energy such as sodium (small atoms or ions, $\Delta H_v = 23$ kcal.). The "substitution" of different anions for electrons in cesium, a metal of much lower cohesive energy ($\Delta H_v = 16.3$ kcal.) should require less energy, and the energy requirement should not be very much different for different anions. The cohesive energy of the solid cesium salt which decreases slightly from chloride to iodide ($\Delta H_s = 39$ and 38 kcal., respectively), should then be a more important factor in determining the heat of solution. In accordance with this notion, the heat of solution was found to decrease slightly from 22 ± 2 for CsCl to 18 ± 1 kcal. for CsI. (auth)

3772

CHAIN BRANCHING IN GLASSY POLYPHOSPHATES: DEPENDENCE ON THE Na/P RATIO AND RATE OF DEGRADATION AT 25°. Ulrich P. Strauss and Theodore L.

Treitler (Rutgers Univ., New Brunswick, N. J.). J. Am. Chem. Soc. 77, 1473-6(1955) Mar. 20.

The previously observed occurrence of an initial decrease of both viscosity and pH in freshly prepared aqueous solutions of glassy sodium polyphosphate was investigated with samples whose Na/P ratios ranged from 0.968 to 1.055. The phenomenon was observed at Na/P ratios up to 1.01. That the effect was due to the hydrolysis of weak bonds in the polymer molecules was confirmed by showing that the first-order rate constants of both the reduced viscosity decrease and the increase in the number of titratable hydrogen ions were equal. This rate constant was found to be $8(\pm 4) \times 10^{-3}$ min.⁻¹ at 25° and was apparently unaffected by the Na/P ratio and the molecular weight of the samples as well as by the pH and the NaBr concentration of the solutions. Evidence that these weak bonds occur at branch points in the polymer chains is presented, and by extrapolation of the data obtained in the rate studies the number of branches originally present in the samples is estimated. For glasses with Na/P ratios greater than unity this number is of the order of one branch for every 1000 P atoms. (auth)

3773

2,5-DIARYLOXAZOLES AND 2,5-DIARYL-1,3,4-OXADIAZOLES. F. Newton Hayes, Betty S. Rogers and Donald G. Ott (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 77, 1850-2(1955) Apr. 5.

The preparation of several 2,5-diaryloxazoles and 2,5-diaryl-1,3,4-oxadiazoles is reported. These compounds may prove suitable for use as organic solution scintillators. (C.W.H.)

3774

THE SODIUM-SODIUM HYDRIDE-HYDROGEN SYSTEM AT 500-600°. M. Douglas Banus, James J. McSharry, and Edward A. Sullivan (Metal Hydrides Inc., Beverly, Mass.). J. Am. Chem. Soc. 77, 2007-10(1955) Apr. 5.

The dissociation pressure of hydrogen in the sodium-sodium hydride-hydrogen system has been measured as a function of temperature and over-all composition of the condensed phase or phases. Measurements have been made at temperatures from 500 to 600° at pressures ranging up to 4600 cm. (auth)

ANALYTICAL PROCEDURES

3775 AD-4479

Southern Research Inst.

DEVELOPMENT OF A PARTICLE COUNTER. PROGRESS REPORT FOR SEPTEMBER AND OCTOBER [1952]. A. L. Thomas, Jr., J. L. Hammond, Jr., and Locke White, Jr. Dec. 3, 1952. 16p. Contract DA-18-064-CML-2101, Report No. 4.

The final assembly and the evaluation are described of a photometer for detecting aerosol particles. A flow system was also assembled which would handle homogeneous aerosols and present to the photometer a well-defined stream of particles diluted with sufficient clean air to prevent the frequent occurrence of more than 1 particle in the field of view. The product of flow rate and allowable concentration is well above the required rate for counting particles, and the minimum diameter of the particle which may be detected is below 0.5 μ. A relative calibration between particle diameter and amplitude of pulse was obtained over the range of diameters from 0.5 to 2 μ. Though not exactly linear or of constant exponent, the relation is unambiguous and useful for size indication. Dis-

tributions of supposedly homogeneous aerosols show a range of sizes which average 0.5 μ but which are as small as 0.25 μ on occasions. An investigation of the intensity of illumination in the sensitive volume showed a total variation of less than 2% in the volume traversed by the aerosol stream. (ASTIA abst.)

ANALYTICAL PROCEDURES

3776 AERE-M/M-78

Atomic Energy Research Establishment, Harwell, Berks (England)

A PORTABLE ARGON PURITY INDICATOR. W. F. Biddle and J. Sheldon. Aug. 6, 1954. 10p.

An apparatus suitable for sampling argon from active dry boxes is described. Indication of purity is by the color of a high-voltage discharge through a continuous-flow sample at 20 m/m of mercury pressure. (auth)

3777 RDB(W)/TN-106

Division of Atomic Energy (Production), Research and Development Branch, Windscale (England)

THE ASHING OF SEAWEED SAMPLES FOR RUTHENIUM ASSAY. Eileen E. Foreman. Oct. 1953. 7p.

The paper describes some experiments carried out to investigate the loss of ruthenium during the ashing of seaweed samples. It is shown that little loss occurs provided that the ashing temperature is not allowed to exceed 500°C. (auth)

3778 UCRL-2929

Radiation Lab., Univ. of Calif., Berkeley

THE AMINO ACID COMPOSITION OF THE PROTEINS OF HUMAN SERUM LIPOPROTEIN. Bernard Shore. Mar. 23, 1955. 4p. Contract W-7405-eng-48.

Spectrophotometric measurement of the dinitrophenyl derivatives of the protein amino acids indicate the following molar ratios for the proteins of the 0.96 to 1.04 g/ml hydrated density lipoproteins: alanine: arginine: aspartic acid + glutamic acid: glycine: leucine: phenylalanine: proline: serine: threonine: valine = 1.0: 0.4: 3.0: 0.7: 2.6: 0.9: 0.5: 1.1: 1.0: 1.0. Ratios for the same amino acids of the protein of the 1.145 g/ml hydrated density lipoprotein are 1.1: 0.4: 3.1: 0.6: 2.3: 0.9: 0.5: 0.9: 0.9: 1.0. Data indicate that the 0.96 to 1.04 proteins are probably of quantitatively identical amino acid composition and that the 1.145 protein is very similar, if not identical with them. (auth)

3779 WIN-10

Raw Materials Development Lab., National Lead Co., Inc. THE SPECTROPHOTOMETRIC DETERMINATION OF TETRAETHIONATE. Oscar A. Nietzel and Michael A. DeSesa. Apr. 18, 1955. 18p. Contract AT(49-6)-924.

The spectrophotometric method of Robinson for the determination of tetrathionate has been modified to yield a procedure of greater sensitivity and accuracy. The procedure depends on conversion of tetrathionate to thiocyanate and determination of the thiocyanate formed with an excess of ferric iron. By developing the color in opaque cylinders, the rapid decomposition of the ferric thiocyanate color has been eliminated for all practical purposes. The use of ferric nitrate and nitric acid instead of ferric chloride and hydrochloric acid has decreased the optical density of the reagent blanks. The optimum concentrations of reagents have been evaluated. By measuring the final color at 460 mμ instead of at 525 mμ a two fold increase in sensitivity has been achieved. A rapid, accurate procedure is presented

for analyzing liquors containing as little as 0.002 g of tetra-thionate per liter. (auth)

3780 AEC-tr-2114

A METHOD FOR THE ANALYSIS OF MICROSCOPIC

QUANTITIES OF HEAVY WATER. R. E. Mardaleishvili, G. K. Lavrovskaya, and V. V. Voevodskii (Voevodsky).

Translated from Zhur. Fiz. Khim. 28, 2195-8(1954). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2645.

3781 AERE-Lib/Trans-475

A SEPARATION PROCESS IN ONE DROP. A CONTRIBUTION TO THE ANNUAL OVEN METHOD AND SPOT TESTING. Herbert Weisz. Translated by F. Hudswell from Mikrochim. Acta, 376-87(1954). 10p.

With the aid of the ring furnace method it has been possible to work out a method of separation taking account of following ions: Pb, Bi, Cu, Cd, Sn, Sb, Fe, Co, Ni, Mn, Cr, Zn, Al, Ti. A drop of about 1.5 μ l is sufficient for the analysis, provided the amounts of the cations present still permit the identification reactions. The detection reactions are conducted on the paper with the aid of familiar reactions, which however have been modified for this particular purpose. Four examples are cited, employing 35 μ g or less. The analysis requires only about one hour. (auth)

3782

ESTIMATION OF THORIUM BY ORGANIC REAGENTS. PART V. SEPARATION OF THORIUM FROM URANIUM AND THEIR CO-DETERMINATIONS BY 2:4-D. Sachindra Kumar Datta and Burupada Banerjee (Darjeeling Government Coll., India). J. Indian Chem. Soc. 31, 929-32(1954) Dec.

2,4-D has been utilized successfully in a wide pH range from 2.6 to 3.4, for the separation of thorium from uranium, when present in a mixture in the ratio 1:1, beyond which double precipitation is necessary, and it works well up to a Th-U ratio of 1:26. Uranium from the filtrate can also be determined with the help of the sodium salt of 2,4-D above pH 5.0. (auth)

3783

STABLE ISOTOPE DILUTION AS AN ANALYTICAL TOOL. Mark G. Inghram (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). Ann. Rev. Nuclear Sci. 4, 81-92(1954).

The isotopic dilution method of chemical analysis in the micro range is described. It is shown that the method provides better sensitivity than that which can be obtained by any other known technique. (K.S.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

3784 AEC-tr-2113

HYDROGEN ISOTOPE EXCHANGE IN HYDROCARBONS IN LIQUID DEUTERIUM FLUORIDE. Ya. M. Varshavskii [Varshavsky] and A. I. Shatenshtain. Translated from Doklady Akad. Nauk S.S.R. 95, 297-9(1954). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3997.

3785 AERE-Lib/Trans-469

THE ENRICHMENT OF HEAVY WATER BY FRACTIONAL DISTILLATION. W. Ehrenberg and H. Jaffke. Translated by E. R. Holley from Z. angew. Phys. 5, 375-6(1953). 4p.

A report is made on experiments for the enrichment of heavy water by fractional distillation. The results lead

to a discussion on the question of which course should be followed in the attempts to raise the separation factor from the value of 1.3 which has been reached to the economically desirable value of 1.65. (auth)

FLUORINE AND FLUORINE COMPOUNDS

3786 ANL-5405

Argonne National Lab.

THE LIQUID-VAPOR EQUILIBRIA OF THE SYSTEM BROMINE PENTAFLUORIDE-BROMINE TRIFLUORIDE. Ray D. Long. Mar. 1955. 120p. Contract W-31-109-Eng-38.

The liquid-vapor equilibria for the system bromine pentafluoride-bromine trifluoride have been measured and correlated. Isothermal diagrams at 50, 75, 100, 125, and 150°C, and an isobaric diagram at 1 atmosphere have been prepared. At higher temperatures, pressures become excessive and bromine trifluoride tends to decompose. It is felt that the smoothed data can be safely extrapolated to 25°C so that the complete 1 atmosphere diagram can be calculated and compared with the experimental isobar. (auth)

3787

THE FLUORIDES OF TITANIUM. X-RAY POWDER DATA AND SOME OTHER OBSERVATIONS. Karl S. Vorres and Frederic B. Dutton (Michigan State Coll., East Lansing). J. Am. Chem. Soc. 77, 2019(1955) Apr. 5.

X-ray diffraction data are reported for TiF_3 , TiF_4 , and $TiOF_2$. (C.W.H.)

GRAPHITE

3788

ELECTRONIC DENSITY OF STATES OF GRAPHITE.

John E. Hove (North American Aviation, Inc., Downey, Calif.). Phys. Rev. 97, 1717-18(1955) Mar. 15.

It is theorized that the effect of including next-nearest neighbors (in the basal plane) is to introduce an asymmetry in the density of states. This follows the general approach of Carter and Krumhansl (J. Chem. Phys. 21, 2238-9(1953)). (C.W.H.)

LABORATORIES AND EQUIPMENT

3789 AERE-C/M-217

Atomic Energy Research Establishment, Harwell, Berks (England)

A SIMPLE MODIFICATION OF A STANDARD CENTRIFUGE FOR USE AT TEMPERATURES UP TO 500°C WITH TEMPERATURE MEASUREMENT DURING OPERATION. J. R. Findlay and J. N. Gregory. July 13, 1954. 7p.

A standard centrifuge has been adapted to operate on molten salt and liquid metal systems up to 500°C with facilities for heating and measuring temperatures during rotation. The modifications consist of a few additional parts and a small furnace built into a standard cup. The permanent structural alterations to the original centrifuge are trivial, and the high temperature modification can be assembled or dismantled in a few minutes. (auth)

3790 RDB-(W)/8103

Research and Development Branch, Industrial Group, Windscale Works, Dept. of Atomic Energy, Windscale, Cumb. (England)

A STUDY OF THE HYDRODYNAMICS OF PULSED

COLUMNS. PART 2. THE CALCULATION OF LOSSES IN SIDE LINES. J. A. Williams, D. J. Little, and W. D. Jones. June 1954. 23p.

A method is presented for the calculation of the pulse amplitude in various side tubes of a pulsed-packed column, the volume displacement, and pressure required in order to achieve given conditions in the column. (C.H.)

RADIATION CHEMISTRY

3791

FISSION RADIOCHEMISTRY (LOW ENERGY FISSION).

L. E. Glendenin and E. P. Steinberg (Argonne National Lab., Lemont, Ill.). *Ann. Rev. Nuclear Sci.* 4, 69-80(1954).

Refinements in the mass and charge distribution of nuclides undergoing thermal fission are reviewed for the period since 1949. An extensive summary of results is discussed in relation to the success of various nuclear models for describing the observed phenomena. (K.S.)

RADIATION EFFECTS

3792

THE EFFECT OF X-RAYS ON SOLUTIONS WHICH CONTAIN FORMIC ACID AND CERIC ION.

Harry E. Spencer and G. K. Rollefson (Univ. of California, Berkeley). *J. Am. Chem. Soc.* 77, 1938-43(1955) Apr. 5.

If ceric sulfate and formic acid are dissolved in 2.8N sulfuric acid, they do not react appreciably under ordinary conditions. If such a solution is exposed to the radiation from an x-ray tube operated at 50 kv. and 45 ma., reaction occurs at a readily measurable rate. The principal products are cerous ion, carbon dioxide, hydrogen and oxygen. It was found that these products alone sufficed to give a material balance with 10% except at high formic acid concentrations. The effects of varying the concentrations of formic acid and of ceric ion and of adding oxygen have been studied. A mechanism has been formulated which gives a quantitative description of the experimental facts. On the basis of this mechanism the yield of radicals from the action of the radiation on water can be estimated. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

3793 MLM-1002

Mound Lab.

RADIOCHEMICALLY PURE CERIUM. (INFORMATION REPORT).

M. L. Salutsky and H. W. Kirby. Aug. 20,

1954. 12p. Contract AT 33-1-Gen-53.

Radiochemically pure cerium was prepared as a carrier for tri- and tetravalent ions in extremely low-level radiochemical analyses, such as urinalysis. One requirement for such a reagent is that it should not contain alpha activity in excess of one count per hour per milligram of cerium. Analyses of a series of commercial salts showed that none of the commercial compounds was suitable for such low level radiochemical work. Radiochemically pure cerium was prepared by three methods: fractional precipitation of the iodate from homogeneous solution, fractional crystallization of the double magnesium nitrate, and fractional crystallization of ceric ammonium nitrate. (auth)

3794

CEROUS CITRATE COMPLEXES, THEIR COMPOSITION, STRUCTURE AND BEHAVIOR.

M. Bobetsky and B. Graus

(Hebrew Univ., Jerusalem, Israel). *J. Am. Chem. Soc.* 77, 1990-3(1955) Apr. 5.

A study of the properties of the cerium(III) citrate complexes in aqueous and 50% alcohol solutions is presented. The composition and structure, possibly, of the cerium(III) citrate complexes and the thorium citrate complexes are similar in many respects. (C.W.H.)

SEPARATION PROCEDURES

3795 AD-42310

Kansas Univ.

RESEARCH AND DEVELOPMENT ON THE EQUILIBRIUM CONSTANTS AND ACTIVITY COEFFICIENTS OF ION EXCHANGE RESINS. FINAL REPORT [FOR] SEPTEMBER 1, 1951-SEPTEMBER 1, 1954.

W. J. Argersinger, Jr., Arthur W. Davidson, G. Elizabeth Wilson, Leslie Leifer, and Norman J. Meyer. Sept. 30, 1954. 106p. Contract DA-23-072-ORD-222.

The silver-sodium, zinc-hydrogen, and silver-hydrogen exchanges on Dowex 50 at 25°C have been extensively investigated. A theoretical treatment of the solvent water activity in exchange equilibrium is presented and applied to the sodium-hydrogen exchange system. The basic principles of a method of determining solution activity coefficients from cation exchange data are discussed, and an approximate treatment is used to determine activity coefficients of AgNO_3 and NaNO_3 in their mixed solutions from the ion exchange measurements described. The determination of individual mean activity coefficients, and their appropriate ratios, from electromotive force measurements on suitable galvanic cells containing mixed electrolyte solutions is discussed generally, and the method is applied to the study of $\text{ZnCl}_2\text{-CdCl}_2$ and $\text{ZnCl}_2\text{-HCl}$ mixed aqueous solutions. (auth)

3796 JENER-34

Joint Establishment for Nuclear Energy Research (Norway) A NEW METHOD FOR SEPARATION OF RADIOACTIVE IODINE-131. Kjell Taubgöhl and Knut Samsahl. 1954. 6p.

A dry distillation method for separating radioactive I^{131} from irradiated tellurium dioxide has been worked out. The tellurium dioxide can be used repeatedly, giving extremely high specific activity, and a minimum of other chemicals are needed for the separation. The new method is less time consuming than the old one. The yield exceeds 90%. (auth)

3797 AERE-Lib/Trans-507

THE CONSIDERATION OF A NUMBER OF RESISTANCES TO DIFFUSION AND TRANSPORT IN DISTILLATION AND SIMILAR PROCESSES OF SEPARATION. Werner Kuhn. Translated by F. Hudswell from *Helv. Chim. Acta* 37, 1407-22(1954). 17p.

The number of separation stages which can be attained in fractionation installations, in the case when the fractionation arrangements consist of plane parallel plates or circular cylindrical tubes, has been stated in the frequently accomplished special case, up to the present, that the time which is necessary for the attainment of the separation effect is assumed to be practically equal to the time which is required for a molecule occurring in the vapor phase in the column to arrive by a diffusion process at the vapor liquid boundary surface. The considerations in the present publication are extended to the case where the time required for the establishment of the separation effects

depends, not only on the resistance to diffusion which is present in the vapor phase, but also, due to the resistance to diffusion originating in the liquid, on a resistance to transport between vapor and liquid as well as, in given cases, on chemical resistances localized in the vapor or in the liquid. The analysis has been carried out in detail in the case where the velocity of translation from the vapor and liquid in the fractionating apparatus is so great that no back-diffusion occurs, as on the assumption of no take-off. (auth)

SPECTROSCOPY

3798

INVESTIGATIONS ON THE BAND-SPECTRA OF THE DIATOMIC OXIDES ZrO, NbO, AND AgO. Ulla Uhler. Stockholm, Ivar Haeggströms Boktryckeri A. B., 1954. 22p.

SYNTHESES

3799 WADC-TR-54-433

George Washington Carver Foundation

RESEARCH ON THE PREPARATION AND PROPERTIES OF HIGH-TEMPERATURE RESISTANT COPOLYMERS. Gerald A. Edwards. May 1954. 21p. Contract AF 33(616)-366.

The reaction between para-dichlorobenzene and alkali metals in the presence of various unsaturated compounds has been investigated for the purpose of determining whether heat resistant copolymers could thus be prepared. Among the unsaturated compounds used in these reactions are vinyl acetate, ethylene, isobutylene, methyl acrylate, acrylonitrile, and butadiene-1,3. From each of these reactions polymeric material melting above 250°C was obtained. From a consideration of the method of preparation and properties of these materials, it is concluded that they are copolymers whose molecules contain rigid segments of phenylene units interspersed with segments consisting of flexible carbon-carbon chains. Thus in these copolymers the properties of polyphenyl, an infusible material, are modified by those of the vinyl polymers. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

3800

VAPOR PRESSURES OF AMERICIUM TRIFLUORIDE AND PLUTONIUM TRIFLUORIDE, HEATS AND FREE ENERGIES OF SUBLIMATION. Stephen C. Carniglia and B. B. Cunningham (Univ. of California, Berkeley). J. Am. Chem. Soc. 77, 1451-3(1955) Mar. 20.

The vapor pressures of solid AmF_3 and PuF_3 were measured in the temperature range ~ 1100 to $\sim 1300^\circ\text{K}$ by the Knudsen method. Separate free energy of sublimation equations, yielding calculated pressures in agreement with observation within $\approx \pm 5\%$, were derived for each of the four samples examined. The experimental data, together with an assumed ΔC_p of sublimation of $-14 \text{ cal mole}^{-1} \text{ deg}^{-1}$, yield: AmF_3 sample D-1, $\Delta F(\text{cal.}) = 112,650 + 32.24T \log T - 155.55T$; AmF_3 sample E, $\Delta F = 112,690 + 32.24T \log T - 155.45T$; PuF_3 sample C-2, $\Delta F = 111,340 + 32.24T \log T - 155.61T$; PuF_3 sample D-2, $\Delta F = 113,180 + 32.24T \log T - 157.13T$. Samples D-1 and D-2 were run simultaneously in a double chambered "twin" effusion vessel, and the results suggest that the greater volatility of PuF_3 at elevated temperatures as compared with AmF_3 is due to a

slightly more positive entropy of sublimation rather than to a smaller heat. (auth)

3801

THE VAPOR PRESSURE OF AMERICIUM METAL. Stephen C. Carniglia and B. B. Cunningham (Univ. of California, Berkeley). J. Am. Chem. Soc. 77, 1502(1955) Mar. 20.

3802

EVIDENCE FOR QUADRIVALENT CURIUM. X-RAY DATA ON CURIUM OXIDES. L. B. Asprey, F. H. Ellinger, S. Fried, and W. H. Zachariasen (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 77, 1707-8(1955) Mar. 20.

The preparation of several Cm oxides has been carried out and their x-ray lattice constants measured. These unequivocally show the existence of an oxide with a O/Cm ratio more nearly 2/1 than 1.5/1 on the basis of lattice constants. (auth)

3803

ELECTRODEPOSITION OF PLUTONIUM. Fletcher L. Moore and Gilbert W. Smith (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 4, 66-9(1955) Apr.

In this investigation, a method was developed to effect uniform, adherent plutonium films on metal plates to be used as alpha standards or for precise fission counting. Unoxidized plutonium (chiefly Pu^{4+}) is electrodeposited from oxalate medium on plates as large as 100 cm^2 with film densities up to 0.13 mg/cm^2 . (auth)

URANIUM AND URANIUM COMPOUNDS

3804

SOME KINETIC STUDIES OF THE TIN(II) REDUCTION OF URANIUM(VI) IN HYDROCHLORIC ACID MEDIA. Robert Lee Moore (General Electric Co., Richland, Wash.). J. Am. Chem. Soc. 77, 1504-6(1955) Mar. 20.

ENGINEERING

3805 AD-28372

Iowa State Coll.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. QUARTERLY PROGRESS REPORT FOR DECEMBER 15, 1953 TO MARCH 14, 1954. 15p. Contract AF 33(616)-94.

Data on the screening of 52 compounds for their thermal stabilities are presented together with generalizations on the effects of different groups. (ASTIA abst.)

3806 AD-28428

Industrial Scientific Co.

THE DICHROMATIC RADIATION PYROMETER. FINAL REPORT. REPORT NO. 233-1. William S. Tandler, Richard H. Tourin, and Morris Grossman. Feb. 1954. 101p. Contract Nonr-444(00).

The dichromatic radiation pyrometer is an instrument for determining temperatures of hot objects, particularly turbine blades and other jet engine parts, by measuring the radiation they emit. The principal feature of this instrument, which distinguishes it from conventional total radiation pyrometers and optical pyrometers, is that the temperature is obtained in terms of the ratio of radiation intensities at 2 different wave lengths in the emission spectrum of the hot part. By this means, the effects of surface emissivity and ambient conditions, which limit or

prevent the use of conventional pyrometers, are eliminated. The basic principles of the dichromatic pyrometer were studied theoretically and experimentally, and an experimental instrument was developed and tested. The results obtained indicated that the instrument represents a practical approach to temperature measurement in jet engines and in similar applications. (auth)

3807

RADIOISOTOPE CONFERENCE, 1954. PROCEEDINGS OF THE SECOND CONFERENCE, OXFORD, 19-23 JULY. VOL. II. PHYSICAL SCIENCES AND INDUSTRIAL APPLICATIONS. J. E. Johnston, R. A. Faires, and R. J. Millett, eds. London, Butterworths Scientific Publications, 1954. 223p.

Seventy papers emphasizing new ideas, new methods, and important new results obtained in industrial application of radioisotopes are presented. Topics discussed include the use of radioactive isotopes in the study of vinyl polymerizations; a method for measurement of diffusion coefficients in polymer solvent systems; double labelling techniques in the Wagner-Meerwein rearrangement; the catalytic isomerization of cycloalkanes; exchange reaction between iodine and methyl iodide; the use of C¹⁴ and S³⁵ in chemical problems of fuel research; tracer studies of poisoning phenomena on solid catalysts; the preparation and possible industrial uses of Kr⁸⁵ and tritium; autoradiographic method for the study of segregation in metals; studies of the purification of metals by the method of zone melting; the measurement of self-diffusion coefficients in binary alloys; a photoneutron method of measuring deuterium; soil moisture determination by neutron scattering; gas counting of natural radiocarbon; the measurement of low specific activity C¹⁴ by liquid scintillation counting; design of an α gage; a tube wall thickness gage with selection of backscattered γ radiations; the use of P³² to study the movement of wood fibers during the process of drafting; water flow and velocity measurements; carbide cutting tool life; the use of radioactive isotopes to overcome electrostatic dangers in hospitals and industry; Ce¹⁴⁴ and Tm¹⁷⁰ as a γ source for industrial radiography; and techniques for studies with a high intensity γ radiation source. Discussions of the papers and literature citations are included. (C.H.)

3808

INDUSTRIAL DUST. HYGIENIC SIGNIFICANCE, MEASUREMENT, AND CONTROL. Philip Drinker and Theodore Hatch. New York, McGraw-Hill Book Co., Inc., 1954. 401p.

HEAT TRANSFER AND FLUID FLOW

3809 AD-1292

Aeronautical Engineering Lab., Princeton Univ.

ON THE RECOVERY FACTOR FOR HYPERSONIC FLOW WITH A SELF-INDUCED PRESSURE GRADIENT. REPORT NO. 217. Ronald F. Probstein and Lester Lees. Jan. 19, 1953. 9p. Contract AF 33(038)-250.

Mathematical equations based on the Prandtl-Meyer relation were formulated. From their solutions it was shown that pressure gradient has no effect on recovery factor for any Prandtl number at least for the case of weak interaction in hypersonic flow. (C.W.H.)

3810 AD-47751

Rocket Lab., Purdue Univ.

INVESTIGATION OF AN ELECTRO-MAGNETIC METHOD FOR MEASURING FLUID FLOW RATES. FINAL RE-

PORT. James H. Fisher, Rocket Lab., Purdue Univ. and Purdue Research Foundation. June 1952. 74p. For M. W. Kellogg Co. Contract AF-33(038)-13668.

The problems of an electromagnetic flowmeter were investigated, and a laboratory test model was designed and fabricated. Calibration, testing, and operation of the model were performed. Difficulty was encountered due to spurious signals in high-frequency operation; this problem was partially solved. Operation at low frequency flow signals was satisfactory. (auth)

3811 LA-1867

Los Alamos Scientific Lab.

A METHOD FOR THE NUMERICAL SOLUTION OF TRANSIENT HYDRODYNAMIC SHOCK PROBLEMS IN TWO SPACE DIMENSIONS. Harwood G. Kolsky. Sept. 27, 1954. 37p. Contract W-7405-eng-36.

A method for numerically solving hydrodynamic problems involving two space dimensions and time is developed based on the von Neumann-Richtmyer method of treating shocks. Finite difference equations for the system are constructed from the basic differential equations of hydrodynamics. Difference formulas are also given for checking the stability of the space-time mesh, and for checking the total energy of the system. The results of four sample shock problems are presented. The requirements imposed on electronic computers by problems of this type, and possible extensions of the method to other types of physical problems, are discussed briefly. (auth)

3812 RM-1351(RAND)

RAND Corp.

NOTE ON THE EFFECT OF CIRCULATION IN HEAT TRANSFER. J. D. Cole. Sept. 24, 1954. 8p.

It is shown that circulation is very effective in producing heat transfer as compared with the non-circulating case. For applications to separated flow fields the comparison should be made relative to the unseparated boundary layer heat transfer. In order to carry this out some estimate of the circulation and temperature distribution must be obtained. (auth)

3813

ON THE PROBLEM OF STABILITY OF PLANE CONVECTIVE MOTION OF LIQUIDS. G. Z. Gershuni. Zhur. Tekh. Fiz. 25, 351-7(1955) Feb. (In Russian)

MATERIALS TESTING

3814 AD-34506

Wayne Univ.

LIFE TEST ESTIMATION PROCEDURES. TECHNICAL REPORT NO. 2. Benjamin Epstein. July 15, 1954. 27p. Contract DA-20-018-ORD-13272.

Procedures are discussed for finding point and interval estimates of the mean of an exponential distribution of life, where the data upon which the estimates are based can arise in various ways. A statistic called "total life" underlies all of the estimates treated in this paper. Several numerical illustrations are given. (auth)

PUMPS

3815 RDB(W)/TN-138

Research and Development Branch, Industrial Group, Windscale Works, Dept. of Atomic Energy, Windscale, Cumb. (England)

EXPERIMENTS ON A 400 GPM, 3 PHASE FLAT LINEAR ELECTROMAGNETIC INDUCTION PUMP AT LOW LINE PRESSURES. J. D. Nixon and T. I. M. Crofts. Mar. 1954. 28p.

It has been found that if the pressure at inlet to the pump tube is reduced below a certain value the characteristic of the pump is altered. The efficiency decreases and a marked fall in flow rate takes place. The criterion for the change in performance is the pressure difference across the walls of the pump tube. The change is independent of temperature over the range 100 to 250°C. The nature of the results suggests that the change in pump performance is related to the pump tube deflection. It has, however, not been possible to determine the exact operating mechanism with the results obtained so far. (auth)

RADIOGRAPHY

3816 AECU-3011

Los Alamos Scientific Lab.

FIELD EVALUATION OF INDUSTRIAL XERORADIOGRAPHY. Grover M. Taylor and Gerold H. Tenney. [1954?]. 31p. Contract [W-7405-eng-36].

Data are summarized from an evaluation of sensitivity, resolution, and technique of xeroradiography when applied as a means of nondestructive testing of samples of Al and steel. X-ray machines of 150, 250, and 1000 kvp, Co⁶⁰, and a 22-Mev betatron were employed as radiation sources. Lead front and back filters and lead masking were used where appropriate. Comparisons are made with data obtained by conventional radiography. (C.H.)

3817

THE SCOPE OF GAMMA-RADIOGRAPHY. L. Mullins (Kodak Ltd., Harrow, Middlesex, England). J. Brit. Inst. Radio Engrs. 15, 131-41(1955) Mar.

The relative merits of gamma-rays and x-rays are discussed with special reference to the practice and scope of radiography. It is shown that the methods are to a large extent complementary and that radiography by gamma-rays has special features which have assisted the rapid expansion of the radiographic inspection of castings and welds. (auth)

VACUUM SYSTEMS

3818 AERE-GP/R-1481

Atomic Energy Research Establishment, Harwell, Berks (England)

A PRESSURE-VACUUM DIAPHRAGM VALVE. (STORES CATALOGUE NO. 4-3/0839-41). R. W. Bowring and R. H. Davies. Aug. 11, 1954. 28p.

This report describes the performance of a pressure-vacuum valve with a completely enclosed and supported diaphragm. The dimensions are discussed and its use in various gas systems detailed. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

3819

THORIUM DETERMINATIONS IN MANGANESE NODULES. Edward D. Goldberg (Scripps Institution of Oceanography, La Jolla, Calif.) and E. Picciotto (Univ. of Brussels, Belgium). Science 121, 613-14(1955) Apr. 22.

A method involving the tracer use of Th²³⁴ is described for determining the Th content of Mn nodules. Results are presented for a number of Pacific Ocean nodules. These preliminary results lend support to the ionium-thorium method for the determination of the rates of accumulation of deep-sea sediments. (L.M.T.)

CERAMICS AND REFRactories

3820

SOLID-STATE REACTIONS AND DIELECTRIC PROPERTIES IN THE SYSTEM MAGNESIA-LIME-TIN OXIDE-TITANIA. L. W. Coughanour, R. S. Roth, S. Marzullo, and F. E. Sennett. J. Research Natl. Bur. Standards 54, 149-62(1955) Mar.

A study has been made of solid-state reactions in the quaternary system MgO-CaO-SnO₂-TiO₂ and in its subordinate binary and ternary systems. Compatibility relations have been determined for each. Extensive solid-solution formation has been noted in the SnO₂-TiO₂, MgO-SnO₂-TiO₂, CaO-SnO₂-TiO₂, and MgO-CaO-SnO₂-TiO₂ systems. Little or no solid solution was observed in the other systems involved. One ternary compound, having the probable formula 2MgO·SnO₂·TiO₂, has been observed. No quaternary compounds were detected. A survey has been conducted of the effect of composition and temperature variations on the dielectric properties of specimens in some of these systems. Indexed X-ray powder patterns are listed for the compounds CaO·TiO₂, CaO·SnO₂, and 2MgO·SnO₂·TiO₂. An unindexed pattern is given for the compound 2CaO·SnO₂. (auth)

3821

METAL-CERAMIC INTERACTIONS: V. NOTE ON REACTIONS OF METALS WITH TITANIUM CARBIDE AND TITANIUM NITRIDE. W. D. Kingery and F. A. Halden (Massachusetts Inst. of Tech., Cambridge). Am. Ceram. Soc. Bull. 34, 109-13(1955) Apr. 15.

Reaction of TiN and TiC with Fe, Ni, Mo, Si, Nb, Ti, and Zr was investigated at 1600 and 1800°C. Reaction interfaces and powder mixtures were studied microscopically and with X-ray techniques. Formation of a new phase, solution in the metal phase, penetration along grain boundaries, and extensive solid solutions were observed in various systems. (auth)

3822

PROGRESS REPORT ON CERMETS. Frank W. Glaser (American Electro Metal Corp., Yonkers, N. Y.). Metal Progr. 67, No. 4, 77-82(1955) Apr.

A survey of the development of cermets in the recent years is presented. Certain metallurgical considerations and mechanical specifications of the cermets are discussed. Recent progress with the titanium carbides, metal borides, and aluminides is reported. (C.W.H.)

CORROSION

3823 AECU-3020

Los Alamos Scientific Lab.

MATHEMATICAL STUDIES ON GALVANIC CORROSION. PART V. CALCULATION OF THE AVERAGE VALUE OF THE CORROSION CURRENT PARAMETER. J. T. Waber, John Morrissey, and John Ruth. [1954?]. 60p. Contract [W-7405-eng-36].

Mathematical analysis for the mean current density has been completed for one general, as well as two limiting, ratios of electrode and corrodent dimensions

using a coplanar, juxtaposed arrangement of long, narrow electrodes. The resulting mathematical expressions were reduced to numerical evaluations, and many of these results have been graphically summarized in perspective illustrations. The characteristic ratio (λ/L) was used to explain the behavior of all similar electrode systems and to emphasize the fact that the relative and not the absolute dimensions of the system establish its behavior. Comparison between the theory and two experimental studies was made, and the agreement was found to be good. (auth)

3824 EES-040009

Naval Engineering Experiment Station, Annapolis

ATMOSPHERIC CORROSION RESISTANCE PROPERTIES OF METALS AND ALLOYS AS A GUIDE IN THE SELECTION OF METHODS FOR PRESERVATION AND PACKAGING. William C. Stewart. June 15, 1953. 73p. (AD-23385)

A survey of atmospheric corrosion field-test data for ferrous and nonferrous alloys is presented as a guide in establishing preserving and packaging requirements for metals subject to storage periods up to 5 yr. The corrosivity of atmospheres in different parts of the world is shown; other data afford comparison between atmospheres in the British Isles and the US. Corrosion rates are given for steels containing small percentages of P, Mn, and Cu, and for other series of steels containing from 0 to 5% Ni and 0 to 18% Cr. Corrosion rates in different atmospheres are given for Cu-, Ni-, Al-, and Mg-base alloys; austenitic steels; bronzes; and die-casting alloys. Exposure-test data of ferrous and nonferrous alloys are presented as obtained from the Passamaquoddy Tidal Power Project at Eastport, Maine (1937-38). Corrosion-test results of specimens exposed for 7.5 yr at Kure Beach, N. C. are also given. (ASTIA abst.)

3825 HW-33881

Hanford Works

THE GALVANIC CORROSION OF ALUMINUM. C. Groot. Jan. 6, 1955. 28p. Contract W-31-109-Eng-52.

The thermodynamics of the corrosion of aluminum are presented in potential-pH diagrams. These show that the hydrous oxides of aluminum have a minimum solubility near pH 6, the dissolution of the oxide film is the rate controlling step in the corrosion of aluminum, so this pH corresponds to a minimum corrosion rate. Electrode processes which bring the pH nearer that minimum decrease corrosion, while electrode processes which bring the pH farther from that minimum increase rates. Thus, in acid solutions, aluminum cathodes are protected and anodes corroded, while in basic solutions anodes may be protected and cathodes corroded. In solutions just on the basic side of the pH of minimum solubility, galvanic effects on the corrosion of aluminum are of minor importance. (auth)

3826 NACA-TN-3282

Columbia Univ.

INTERGRANULAR CORROSION OF HIGH-PURITY ALUMINUM IN HYDROCHLORIC ACID. II. GRAIN-BOUNDARY SEGREGATION OF IMPURITY ATOMS. M. Metzger and J. Intrater. [Oct. 23, 1953]. 33p.

The variation in the rate of intergranular corrosion of single-phase high-purity aluminum in 20% hydrochloric acid as a function of iron content and final-annealing temperature is attributed to the segregation to atomic sites

in the grain-boundary region of iron and possibly other impurity atoms. The experimental results are analyzed by reference to a distribution function, obtained by statistical mechanical methods, which gives the equilibrium fraction of certain sites in the boundary which are occupied by solute atoms in terms of the interaction energy for the segregation of the solute atoms at these sites. (For preceding report in series see NACA-TN-3281.) (NACA abst.)

3827 NP-5583

Mine Safety Appliances Co.

EFFECT OF OXYGEN ON MASS TRANSPORT OF STAINLESS STEEL COMPONENTS IN SODIUM. J. W. Mausteller and E. F. Batutis. Mar. 16, 1955. 18p. Contract NObs-65426, Technical Report 36.

The transport of some radioactive type-347 stainless steel constituents in 925°F sodium has been studied in isothermal systems operated at oxygen contents of 0.010, 0.005 and 0.003 wt. % O₂. Ratios of the transfer rate of the parent stainless steel at high and low oxygen contents were 54/1, 17/1, 5/1 and 4/1, based on transport of Co⁶⁰, Fe⁵⁹, Ta¹⁸², and Mn⁵⁴ respectively. Transport rates of the stainless steel at high oxygen level, based on transport of the source isotopes were 12, 541, 58 and 272 $\mu\text{g ss/cm}^2$ active stainless steel/mo. Concentrations of tantalum, antimony and cobalt in 925°F sodium were 7.7×10^{-3} , 0.33 and 3.0×10^{-4} ppm at 0.010 wt. % O₂. In sodium containing 0.003 wt. % O₂ the concentrations dropped by a factor of five. (auth)

GEOLOGY AND MINERALOGY

3828 TEM-644

Geological Survey

AIRBORNE RADIOACTIVITY SURVEY OF PARTS OF THE ATLANTIC OCEAN BEACH, VIRGINIA TO FLORIDA. R. M. Moxham and R. W. Johnson. June 1953. 1p.

A map showing the results of an airborne radioactivity survey along the Atlantic Ocean Beach from Cape Henry, Va., to Cape Fear, N. C., and from Savannah Beach, Ga., to Miami Beach, Fla., is presented. Fourteen areas of abnormal radioactivity apparently due to radioactive minerals associated with black sands were detected between Savannah Beach, Ga., and Anastasia Island, Fla. (J.E.D.)

3829

RABBITTITE, A NEW URANYL CARBONATE FROM UTAH. Mary E. Thompson, Alice D. Weeks, and Alexander M. Sherwood (U. S. Geological Survey, Washington, D. C.). *Am. Mineralogist* 40, 201-6 (1955) Mar.-Apr.

Rabbitite is a new hydrated calcium magnesium uranyl carbonate found in the Lucky Strike No. 2 mine, San Rafael district, Emery County, Utah, in July 1952. It is pale green, finely acicular to fibrous, silky, and occurs as an efflorescence on the mine wall. It is optically biaxial, probably positive, with indices of refraction $\alpha = 1.502 \pm 0.005$, $\beta = 1.508 \pm 0.005$ and $\gamma = 1.525 \pm 0.003$. The specific gravity is about 2.6. The chemical analysis shows CaO 10.6%, MgO 9.2%, UO₃ 37.4%, CO₂ 17.8%, H₂O 24.5%, acid insoluble 0.5%; total 100%, and indicates the formula Ca₃Mg₃(UO₄)₂(CO₃)₆(OH)₄·18H₂O. An x-ray rotation photograph of a small bundle of fibers shows the unit cell length $c_0 = 9.45 \pm 0.05$ Å. From the indexing of hk0 reflections a_0 is thought to be 32.6 ± 0.1 Å and b_0 23.8 ± 0.1 Å, with Z = 8. (auth)

3830

APPLICATION OF THE ELECTRON MICROSCOPE TO

MINERALOGIC STUDIES. Edward Dwornik and Malcolm Ross (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist **40**, 261-74 (1955) Mar.-Apr.

A discussion of the use of the electron microscope in mineralogic studies and of sample preparation is followed by a series of electron photomicrographs showing the size, shape, and crystal habit of fine fractions of some uranium-bearing minerals from the Colorado Plateaus, lignite from North and South Dakota, phosphate minerals from Florida, and minerals synthesized in the laboratory. The information obtained from these photographs is useful in establishing paragenetic relations of associated minerals in uranium deposits, in supplementing mineralogic descriptions, and in guiding and checking separation techniques. (auth)

3831

PHOTOGEOLOGIC MAP OF THE WOODSIDE-5 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-5. P. P. Orkild. Washington, U. S. Geological Survey, 1955. \$0.50.

3832

PHOTOGEOLOGIC MAP OF THE CARLISLE-14 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-6. R. J. Hackman. Washington, U. S. Geological Survey, 1955. \$0.50.

3833

PHOTOGEOLOGIC MAP OF THE EMERY-2 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-9. J. S. Detterman. Washington, U. S. Geological Survey, 1955. \$0.50.

3834

PHOTOGEOLOGIC MAP OF THE TIDWELL-7 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-12. V. H. Sable. Washington, U. S. Geological Survey, 1955. \$0.50.

3835

PHOTOGEOLOGIC MAP OF THE KAIPAROWITS PEAK-8 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-14. J. S. Detterman. Washington, U. S. Geological Survey, 1955. \$0.50.

3836

GEOLOGY OF THE HIGH CLIMB PEGMATITE, CUSTER COUNTY, SOUTH DAKOTA. Douglas M. Sheridan. U. S. Geol. Survey Bull. **1015-C**, 1955. 40p. \$0.65 (GPO).

The High Climb pegmatite, Custer County, S. Dak., belongs to the series of pegmatitic and granitic rocks that characterize the Harney Peak region of the southern Black Hills. It intrudes pre-Cambrian metamorphic rocks consisting chiefly of quartz-mica schist. Along part of the pegmatite contact the country rock has been altered to a tourmaline-rich schist. The structure of the pegmatite, in general, is concordant with the westward-dipping schistose structure of the country rock, but locally the pegmatite cuts it. The main part of the pegmatite is an irregularly shaped pipe that plunges 45° N. 40° W., parallel to the average plunge of rolls in the footwall. A small northern extension of the pegmatite has a lenticular shape, and cuts the schist at a low angle. Rolls in this part of the pegmatite have an average plunge of 28° N. 25° W. One large north-trending crestal roll divides the outcrop of the northern segment of the pegmatite into two parts. The pegmatite has a well-defined internal structure and is made up of five zones. The outer units, a fine-grained wall zone consisting of

albite-quartz pegmatite, and a medium-grained first intermediate zone consisting of albite-quartz-muscovite pegmatite, form incomplete concentric shells. The second intermediate zone, perthite-quartz-albite pegmatite, forms a hood-shaped unit between the outer units and the third intermediate zone along the crest and hanging-wall of the pegmatite. The third intermediate zone, a concentric shell of quartz-cleve-landite pegmatite, surrounds a lenticular core of quartz pegmatite containing altered spodumene. In addition to the five zones, a fracture-filling unit of quartz-perthite-muscovite-albite pegmatite and a possible sixth zone (or replacement unit?) of very fine-grained muscovite pegmatite were recognized. The essential minerals of the pegmatite include microcline-perthite, quartz, albite, and muscovite. Accessory minerals include tourmaline, beryl, amblygonite (variety montebrasite), apatite, columbite-tantalite, loellingite, altered spodumene, many unidentified dark-colored phosphate minerals, a manganese-bearing carbonate, garnet, and chalcopyrite. A satisfactory explanation of the origin of the pegmatite requires processes of fractional crystallization and incomplete reaction in a restricted system. The concentric zonal structure and the general increase in grain size from the wall zone to the core suggest that the pegmatite units formed in successive order by crystallization from the walls inward. No true replacement stages occurred. Beryl, amblygonite, potash feldspar, columbite-tantalite, scrap mica, and sheet mica have been produced as industrial minerals. (auth)

3837

RARE-EARTH MINERAL DEPOSITS OF THE MOUNTAIN PASS DISTRICT, SAN BERNARDINO COUNTY, CALIFORNIA. J. C. Olson, D. R. Shawe, L. C. Pray, and W. N. Sharp. U. S. Geol. Survey Profess. Paper **261**, 1954. 75p. \$3.00. (GPO).

3838

PRELIMINARY DESCRIPTION OF COFFINITE—A NEW URANIUM MINERAL. L. R. Stieff, T. W. Stern, and A. M. Sherwood (U. S. Geological Survey, Washington, D. C.). Science **121**, 608-9 (1955) Apr. 22.

This brief description includes results from x-ray diffraction and infrared absorption studies. The proposed chemical formula for coffinite is $U(SiO_4)_{1-x}(OH)_{4x}$. Attempts to synthesize $USiO_4$ in the laboratory have not been successful to date. (L.M.T.)

3839

AGE OF URANINITES FROM CRYSTALLOGRAPHIC DATA. Henry R. Hoekstra and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). Nature **175**, 605 (1955) Apr. 2.

It is suggested by the authors that the proposal submitted by Wasserstein (Nature **174**, 1004 (1954)) for the age determination of uraninites is of doubtful value because of the exclusion of several important factors. These factors include the alteration of the lattice dimensions of the uraninites due to the oxidation from weathering and due to radiation damage, and the presence of rare-earth and alkaline-earth oxides in the ores. (C.W.H.)

METALS AND METALLURGY

3840 AD-5397

Metallurgical Labs., Dow Chemical Co.

ROOM- AND ELEVATED-TEMPERATURE PROPERTIES OF MAGNESIUM ALLOYS CONTAINING THORIUM, RARE EARTHS AND ZIRCONIUM. FINAL TECHNICAL RE-

PORT [FOR] APRIL 2, 1951–APRIL 2, 1952. PHASE I.

PART I. 81p. Contract AF 33(038)16655.

Mg + Th + rare earths + Zr, Mg + Th + Mn, Mg + Th + MM + Mn, Mg + Zn + Th, Mg + Zn + Th + Zr, Mg + Di + Zn + Zr, Mg + Ce/Di + Zr, and Mg + Th + rare earths alloys have been studied in the cast and in the extruded states over a practical composition range. The results clearly show that the strength properties of cast Mg + Th + Zr are increased, at temperatures up to 500°F by rare-earth additions. With the exception of Mg + Th + Zn, all the other alloys have tensile properties comparable to Mg + Th + Zr at temperatures up to 500°F. The creep resistance of the cast alloys at 500 and 600°F is definitely inferior to that of Mg + Th + Zr. One alloy, Mg + 2 MM + 1 Th + 1 Mn, does have exceptional creep resistance at the higher temperatures. The addition of Zr to this alloy reduces the grain size and raises room- and elevated-temperature properties. The Mg + Zn + Th + Zr system represents the most promising wrought alloys. Mg + 3Zn + 3Th + Zr alloys has an outstanding combination of room- and elevated-temperature properties in the T5 condition. The evaluation of the fabrication characteristics of cast JK31 alloy shows that optimum properties may be obtained over a wide range of heat treating and aging time and temperatures. Aging or exposing for prolonged periods of time at temperatures up to and including 500°F has no significant effect on the strength properties or creep resistance of this alloy. Exposure at 600°F does result in a substantial loss in strength and creep resistance. Due consideration should be given to this effect in applications where prolonged exposure at 600°F is anticipated. (auth)

3841 AD-6685

American Electro Metal Corp.

INVESTIGATION AND EVALUATION OF NEW HIGH TEMPERATURE MATERIALS. [QUARTERLY] PROGRESS REPORT NO. 3 [COVERING THE PERIOD] NOVEMBER 1, 1952 TO FEBRUARY 1, 1953]. 28p. Contract AF 33(616)-109.

3842 AD-8941

Engineering Research Inst., Univ. of Mich.

THE INFLUENCE OF SURFACE TREATMENT ON THE FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PROGRESS REPORT NO. 4. L. Thomassen, M. J. Simott, and A. W. Demmler, Jr. Feb. 1953. 11p. Contract AF33(616)-26.

The material under test was from a single heat of Ti-75A with the following content: 0.025% C, 0.061% N, 0.19% Fe, and the balance Ti. The specimens were machined from 0.002 to 0.050 in. of final size and annealed in argon for $\frac{1}{2}$ hr at 1450°F. Tests on shot-peened, rough-machined, machined and hand-polished, and hand-polished surfaces indicated that only the shot-peened surface increased fatigue strength. At high stresses sufficient to cause failure after 10,000 to 30,000 c and test speeds of 1720 rmp, heating attributed to internal friction was so pronounced that the fracture and adjacent areas showed temper colors (600 to 700°F). A considerable scatter of test results was obtained in testing specimens at any given stress and surface condition. The cause of scatter was undetermined but was not considered a result of variations in surface preparation. (ASTIA abst.)

3843 AD-16551

Ryan Aeronautical Co.

TITANIUM FORMABILITY AND WELDING CHARACTERISTICS. MONTHLY PROGRESS REPORT NO. 8. B. Holland and D. S. Adams. June 10, 1953. 24p. Contract AF-33(600)22169. (G-17-53)

Investigations of electrode pressures revealed that the lower pressures (800 to 2000 lb) produced a coarse-grained nugget and that increasing the electrode pressure resulted in a finer grained structure. Tension and shear samples welded with an electrode pressure of 870 lb were compared with those welded with a pressure of 2400 lb, the near-optimum pressure. Embrittlement testing of 0.037- and 0.063-in. Ti-75A was initiated, and preliminary results indicate that commercially pure Ti is not embrittled appreciably during exposure in the synthetic exhaust gas at 1000°F. Galling and seizing tests were completed, and the galling characteristics of Ti, stainless steel, and Inconel were compared. Inconel-W exhibited the worst galling characteristics. Ti showed a resistance to galling and seizing equal to that of stainless steel and superior to that of Inconel. (auth)

3844 AD-17020

Pennsylvania State Coll. School of Mineral Industries REFRactory MATERIALS FOR USE IN HIGH TEMPERATURE AREAS OF AIRCRAFT. BI-MONTHLY PROGRESS REPORT. MEMO REPORT NO. 15. N. R. Thielke. Oct. 16, 1952. 41p. Contract [AF616]-139].

The preparation of aluminum titanate and its structural, thermal, and mechanical properties were investigated. A melting temperature of 1865°C and a region of instability between 1260 and about 860°C, plus extreme thermal expansion anisotropy in the crystal give rise to unusual properties in the matured crystalline aggregate. These include negative expansion coefficients, marked resistance to thermal shock, thermal expansion hysteresis, and low transverse strength. The expansion behavior and strength of matured aggregates are variously altered by heat treatment, by kiln atmosphere and by incorporation of minor amounts of oxides or glasses. Aluminum titanate is recommended as a thermal shock-resistant refractory material in applications involving low tensile loads and oxidizing conditions at temperatures within its stability ranges. Fabricated shapes may serve satisfactorily as nozzle diaphragm blades, flame tube liners, refractory coatings or other ceramic elements of combustion systems. (auth)

3845 AD-18056

Horizons, Inc.

INVESTIGATION OF A NEW METHOD FOR THE DETERMINATION OF THE COEFFICIENTS OF SURFACE DIFFUSION OF METALS. QUARTERLY PROGRESS REPORT NO. 2. Samuel J. Strindberg. Sept. 22, 1953. 11p. Contract AF18(600)-644.

3846 AD-21020

Battelle Memorial Inst.

EFFECT OF ELEVATED TEMPERATURE ON THE FATIGUE STRENGTH OF SINTERED ALUMINUM POWDER. QUARTERLY PROGRESS REPORT NO. 3 [FOR JULY 15–OCTOBER 15, 1953]. W. S. Hyler and H. J. Grover. Oct. 15, 1953. 11p. Contract AF33(616)-434.

Axial-load fatigue tests have been run on notched and unnotched specimens of M-276 sintered aluminum

powder. The test results are summarized and plotted. On the basis of results so far, it appears that the fatigue limit of unnotched M-276 at 800°F is of the order of 8000 psi. For specimens notched with K_t of approximately 3, the fatigue limit appears to be of the order of 3000 to 3500 psi. (auth)

3847 AD-21076

Pitman-Dunn Labs., Frankford Arsenal

A BOTTOM-POUR ARC TYPE FURNACE FOR MELTING AND CASTING TITANIUM. O. W. Simmons, R. E. Edelman, and H. McCurdy. Sept. 1953. 22p. (R-1165)

A direct current arc, bottom-pour furnace has been developed to make contaminant-free titanium and titanium alloy castings. The maximum heat produced was 13.5 pounds from a 25-pound charge; thus, the heat-to-charge efficiency is 54%. The furnace consists of a water-cooled copper crucible and a separate mold cavity. The whole apparatus is surrounded by a gas-tight chamber with appropriate water cooling. The heat is introduced by an arc struck between a water-cooled tungsten-tipped electrode and the titanium charge. An argon-helium mixture provides the inert atmosphere which protects the molten titanium from gaseous contamination. Machined graphite was used as the mold material. A 3-inch square molybdenum sheet 0.002 inch thick acted as a plug to prevent the premature pouring of the molten metal. (auth)

3848 AD-22854

Horizons, Inc.

INVESTIGATION OF A NEW METHOD FOR THE DETERMINATION OF THE COEFFICIENTS OF SURFACE DIFFUSION OF METALS. QUARTERLY PROGRESS REPORT NO. 3. Anthony J. Kolk and Samuel J. Strindberg. Nov. 30, 1953. 22p. Contract AF-18(600)-644.

Surface diffusions of Ag-Au couples heat treated at 110°C for 4 hr in air at 2μ Hg pressure and diffusion annealed at 100°C in air at about 10μ Hg pressure for 14 hr are discussed. An interferometric examination of the diffusion couple was made. A steady-state method is given for measuring the compositions at various distances from the interface, including steady-state flow and surface diffusion equations. An additional distance measurement method is presented by electrolytically removing the Ag from the Au surface using the electrochemical potential of Ag vs. Au. (J.A.G.)

3849 AD-25802

Armour Research Foundation

INVESTIGATION OF THE METALLURGICAL CHARACTERISTICS OF 36% ALUMINUM TITANIUM-BASE ALLOY. QUARTERLY REPORT NO. 5 [FOR] SEPTEMBER 1, 1953-NOVEMBER 30, 1953. J. B. McAndrew and H. D. Kessler. Jan. 18, 1954. 15p. Contract AF33(616)-196.

Casting methods have been evolved which are satisfactory for the production of tensile specimens of Al-Ti alloy. Sufficient exploration of powder metallurgy characteristics of the Ti-36% Al alloy has been done to indicate that hot pressing of the alloy powders is entirely feasible. Cold pressing and sintering have not yet produced compacts approximating theoretical density. With respect to oxidation, it seems unlikely that silver additions will be helpful at temperatures much above 1000°C; tantalum is somewhat less effective than niobium in imparting oxidation resistance. (auth)

3850 AD-30797

American Electro Metal Corp.

INVESTIGATION OF THE INTERMETALLIC COMPOUNDS OF ALUMINUM. PROGRESS REPORT NO. 4 [FOR FEBRUARY 15, 1954 TO APRIL 15, 1954]. William H. Herz. Apr. 15, 1954. 12p. Contract AF33(038)-10716.

Impact tests made on NiAl + 4% Zr produced excellent results. The sintering of NiAl + Ti was continued. Stress-rupture values were in the same range as hot-pressed pieces of similar composition and superior to any previous value obtained with NiAl or NiAl + Ni. Warping difficulties were overcome. The sintering of NiAl + Zr was successful, and the stress-rupture testing of such pieces produced results better than those obtained with hot-pressed pieces of the same composition. Hot rolling experiments were initiated. A new batch of homogeneous TiAl was produced, and preliminary cold pressing, presintering, and sintering experiments were conducted. (For preceding period see AD-28877.) (ASTIA abst.)

3851 AD-34924

Armour Research Foundation

EFFECTS OF VIBRATIONS ON SOLIDIFICATION OF METALS. SUMMARY REPORT [FOR] JUNE 10, 1953-JUNE 9, 1954. R. S. Richards and W. Rostoker. June 24, 1954. 61p. Contract DA-11-022-ORD-1307.

The effects of 60 cps vibration upon the solidification of an aluminum-4.35% copper-1.28% silicon alloy were investigated. The effects of this vibration applied to the freezing alloy include: increasing reduction in grain size with increasing amplitude of vibration, elimination of shrinkage pipe, complete counteraction of the grain-coarsening effects of superheat, reduction in gas porosity in gassed melts, and counteraction of the grain-coarsening effects at slow cooling. This process also eliminated the dendritic form of the grains and slightly increased the inverse segregation which occurs in this alloy. The vibration produced a significant increase in elongation over the non-vibrated samples. This was correlated with the reduced grain size associated with vibrated metals. Grain size was also found to correlate with a maximum tensile strength. There was no correlation between amount of porosity and elongation or ultimate tensile strength. (auth)

3852 AD-35044-A

Metallurgical Labs., Dow Chemical Co.

A FUNDAMENTAL STUDY OF NATURAL AND SYNTHETIC FILMS ON MAGNESIUM AND ITS ALLOYS. PHASE III. QUARTERLY REPORT NO. 5 [FOR THE PERIOD] APRIL 1, 1953 TO JULY 1, 1953. REPORT NO. 15719. 17p. Contract AF 33(038)-16655.

The thickness of the Dow No. 17 film increases at the same linear rate with time of anodization at constant current density for both the a-c treatment and the d-c treatment. The anodization voltages at constant current density are logarithmic functions of the anodization time, but these functions differ for the two types of current. There are no marked differences in the microstructure between the a-c film and the d-c film, and the macroscopic appearance of the two films is very similar for films of the same thickness. All No. 17 films of sufficient thickness to be resolved at 500X under the light microscope show the green coloration characteristic of the chromic ion. The cracks formed in the Dow No. 7 film by dehydration penetrate the film, but even after moderately

severe dehydration, they are too fine to be considered serious corrosion sites. (auth)

3853 AD-35105

Armour Research Foundation

EXPLORATION OF VANADIUM-BASE ALLOYS.

QUARTERLY REPORT NO. 11 [COVERING THE PERIOD] DECEMBER 1, 1953–FEBRUARY 28, 1954. W. Rostoker. Mar. 17, 1954. 15p. Contract AF 33(038)-8517.

Surface protection treatments for vanadium–40% titanium–5% aluminum alloys are briefly presented. The preliminary studies on forgeability and hot tensile strengths of alloys based on alumino-thermic vanadium with titanium and carbon additions are reported. (auth)

3854 AD-35109

Armour Research Foundation

STUDY OF THE EFFECTS OF ALLOYING ELEMENTS ON THE WELDABILITY OF TITANIUM SHEETS. QUARTERLY REPORT NO. 5 [FOR] NOVEMBER 1, 1953 TO APRIL 15, 1954. H. M. Meyer and Orville T. Barnett. May 11, 1954. 39p. Contract AF-33(616)-206.

The preparation of the weld specimens is described, beginning with sponge titanium and listing the individual production steps. The Vickers hardness after each individual operation is measured and calibrated by means of unalloyed titanium heats. The hardening effect remaining after various cleaning techniques is shown, and a method for minimizing it has been worked out. Nine out of eleven compositions of the 5% Al–Ti alloy series have been welded, and their mechanical properties tested and tabulated. The 8% Al–Ti was tested and proved to be weld brittle. However, a method has been discovered and described by which the as-welded sheet retains its full ductility. (auth)

3855 AD-41478

Battelle Memorial Inst.

EFFECT OF ELEVATED TEMPERATURE ON THE FATIGUE STRENGTH OF SINTERED ALUMINUM POWDER. QUARTERLY PROGRESS REPORT NO. 5 [COVERING PERIOD APRIL 15 TO JULY 15, 1954]. W. S. Hyler and H. J. Grover. July 15, 1954. 18p. Contract AF 33(616)-434.

Axial-load fatigue-test results are reported on aluminum alloys M257 and M276 at 800, 900, and 1000° F. Equipment and procedures are reported. (For preceding period see AD-26783.) (J.E.D.)

3856 AD-43830

Smith, A. O., Corp.

FLASH WELDABILITY OF HIGH STRENGTH TITANIUM BASE ALLOY OF COMPOSITION 1Cr–1Fe–3Mn–1Mo–IV. SUPPLIED BY BATTELLE MEMORIAL INSTITUTE. J. J. Duro. Mar. 15, 1954. 16p. Contract AF 33(038)-20582. (AD-223)

3857 AD-45710

Battelle Memorial Inst.

AN INVESTIGATION OF THE MECHANISM BY WHICH BORON INCREASES THE HARDENABILITY OF STEEL. QUARTERLY REPORT NO. 10 FOR THE PERIOD JULY 1, 1954 TO SEPTEMBER 30, 1954. C. R. Simcoe, R. E. Maringer, R. S. Doig, A. R. Elsea, and G. K. Manning. Sept. 30, 1954. 29p. Contract AF-18(600)-155.

Experimental results showed that the hardenability of a boron steel varied considerably with variations in austenitizing temperature. It was shown further that this varia-

tion in hardenability was accompanied by grain growth and may have been caused by boron concentration at the grain boundaries as a result of decreased grain-boundary area with increased grain size. Also, there appeared to be a temperature effect that was independent of grain size. The temperature effect was hardly detectable at boron contents of 0.0001 to 0.0004%, but increased with increasing boron content. (auth)

3858 BM-RI-5117

Bureau of Mines

THE FABRICATION OF ARC-MELTED INGOTS OF TITANIUM AND TITANIUM–MANGANESE ALLOYS INTO PLATE. R. W. Huber, V. C. Petersen, and R. C. Wiley. Oct. 1954. 38p.

Three arc-melted ingots, two of a titanium–7% manganese alloy and the third of unalloyed titanium, were forged and rolled into $\frac{3}{4}$ -inch plate; comparative data were obtained on these processes. The finished plate was tested for mechanical and other properties. These properties were correlated with sponge purity, forging technique, rolling temperature, and cooling rate from the rolling temperature. For the alloy material, transformation data were obtained, and their age-hardening characteristics were studied. The temperature-impact relationship was established for rolled sections from all three ingots. (auth)

3859 EES-040029C

Naval Engineering Experiment Station, Annapolis

THE ELEVATED TEMPERATURE PROPERTIES OF HASTELLOY X. W. Lee Williams. Nov. 30, 1953. 11p. (AD-23498)

The tensile properties at room temperature and the creep and stress-rupture properties at 1350 and 1500°F were determined for annealed Hastelloy X bar stock. The alloy had a nominal composition of 22% Cr–45% Ni–9% Mo. The elevated temperature strength properties were roughly equivalent to those of the leaner 16% Cr–25% Ni–6% Mo alloy. (auth)

3860 EES-9C(2)966861

Naval Engineering Experiment Station, Annapolis

BASIC INFORMATION ON THE BEARING PROPERTIES OF VARIOUS MATERIALS IN LIQUID METALS. [REPORT NO. 2]. M. R. Gross. June 11, 1951. 34p.

Bearing properties of various materials exposed to a liquid metal environment are presented. Results obtained to date in the rolling contact, sliding contact, and hot hardness tests are presented. The data indicate that welding and seizure of both the rolling and sliding components are responsible for the unsatisfactory performance of standard antifriction bearings in NaK. Aluminum and magnesium base material were found to be excellent under sliding contact with SAE 52100 steel. Accordingly, recommendations are made for the investigation of retainers and journal bearings of these materials. The results of the current tests and future plans are discussed. (For preceding report in series see EES-9C966861.) (auth)

3861 NAA-SR-1159

North American Aviation, Inc.

ON THE RECOVERY OF ELECTRICAL RESISTANCE OF COLD-WORKED GOLD. Charles J. Meechan and Herman M. Dieckamp. Apr. 15, 1955. 17p. Contract AT-11-1-Gen-8.

A study of the recovery of electrical resistance in Au following cold work at room temperature has been made

in the range 100 to 210°C. Throughout this temperature range, activation energies associated with this recovery process have been determined. In the range of most rapid recovery, 155 to 195°C, as indicated by a tempering curve, a mean value of 1.29 ± 0.06 ev has been obtained from 30 separate determinations of the activation energy. Even though the recovery may involve other more complicated defects, it is believed that the rate controlling process is the motion of vacancies. As a result of analogies between this work and similar more detailed studies on Cu, the 1.29 ev activation energy has been assigned to the migration of vacancies in Au. (auth)

3862 NAA-SR-1239

North American Aviation, Inc.

SAMPLING OF METALLIC URANIUM BY ELECTROLYTIC DISSOLUTION. James R. Foltz, Weldon J. Gardner, and Fred D. Rosen. Apr. 15, 1954. 11p. Contract AT-11-1-Gen-8.

The application of electrolytic drilling techniques to the sampling of metallic solids is discussed. A remotely operated apparatus for sampling metallic ingots of irradiated nuclear fuel materials is described, and the operational procedure involved is presented. (auth)

3863 NACA-TN-3351

Battelle Memorial Inst.

PLASTIC DEFORMATION OF ALUMINUM SINGLE CRYSTALS AT ELEVATED TEMPERATURES. R. D. Johnson, A. P. Young, and A. D. Schwope. [Dec. 29, 1953]. 76p.

A study was made of plastic deformation of aluminum single crystals over a wide range of temperatures. Results are presented of constant-stress creep tests, constant-load-rate tests, and constant-load creep tests. The effect of crystal orientation on the operative slip system was determined. The effect of small amounts of prestraining was studied and two high-resolution X-ray techniques were used to detect and follow the strain. Light and electron microscopy were used to study the complex nature of slip bands and kink bands on specimens deformed at elevated temperatures. (NACA abst.)

3864 RDB(W)/TN-173

Research and Development Branch, Industrial Group, Windscale Works, United Kingdom Atomic Energy Authority, Windscale, Cumb. (England)

THE WELDING OF 18/13/1 STAINLESS STEEL. A REVIEW OF PROGRESS TO AUGUST 31, 1954. THE EFFECT OF WELDING CONDITIONS ON THE FERRITE CONTENT OF 18/9/1 STAINLESS STEEL WELD METAL. M. G. Hipkins, J. K. Henderson, and R. O. L. Cadman. Oct. 1954. 22p.

The influence of welding conditions on the ferrite content of weld deposits having a nominal composition of 18 per cent chromium, 9 per cent nickel, 1 per cent niobium has been investigated. The Rosiwal method of micrometric analysis was used to assess the ferrite contents of the deposits which were laid down under a wide range of welding conditions. Additionally a ferrometer capable of estimating the ferrite content by magnetic means was constructed and calibrated. The results showed that the main factor in controlling the ferrite content of the deposits was the chemical composition of the weld metal. Although a secondary effect was produced by varying the welding thermal cycle this was insignificant when compared with that due to chemical composition. (auth)

3865 RL-1009

General Electric Research Lab.

INVESTIGATIONS OF DEFORMATION AND FRACTURE OF METALS. PROGRESS REPORT NO. 2 [FOR] AUGUST 16-NOVEMBER 15, 1953. W. R. Hibbard, Jr. Nov. 16, 1953. 11p. Contract AF33(616)-2120. (AD-25526)

The results of tensile testing high-purity Al as a function of temperature, strain rate, and grain size were further analyzed. Curves showing the above tensile and creep behaviors are presented. Compression ultimate, compression yield, and tensile data were obtained for cold-worked Mg-Al alloy, and typical results are shown. (J.A.G.)

3866 SO-2038

General Electric Research Lab.

SELF-DIFFUSION IN DILUTE BINARY SOLID SOLUTIONS. R. E. Hoffman, D. Turnbull, and E. W. Hart. Mar. 1955. 20p. Contract W-31-109-Eng-52. (RL-1259)

The coefficient of self-diffusion of silver, D_{Ag} , has been measured as a function of the atom fraction X of the substitutional solutes Pb, Cu, Al, or Ge. In general, the results can be described by an equation of the form $D_{Ag} = D_{Ag}^0 \exp(bX)$, where b is a temperature dependent constant greater than zero. However, a linear relation $D_{Ag} = D_{Ag}^0(1 + bX)$ is somewhat more satisfactory for the Ag-Pb and Ag-Cu solutions. The coefficient of self-diffusion of lead, D_{Pb} , in infinitely dilute solution of Pb in Ag was found to be $D_{Pb} = 0.22 \exp(-38,100/RT) \text{cm}^2/\text{sec}^{-1}$, and at 1000°K, $D_{Pb} \approx 13 D_{Ag}^0$. The self-diffusion coefficients of the solvent and solute (D_1 and D_2 , respectively) are, to a certain degree, interrelated, and a formal theory for this interrelationship is developed on the basis of a lattice vacancy mechanism. It is supposed that the solvent atoms diffuse at a different rate within disturbed regions, immediately surrounding solute atoms, than outside them. If $D_2 > D_1$, it follows from our formal theory that the movement of the regions is the primary mechanism for bringing solvent atoms into them and $D_1 = (1 - \alpha X)D_1^0 + \alpha X D_2$, where α is the number of effective solvent-vacancy exchanges within the region during the period in which its center moves one lattice spacing. The experimental results on lead are entirely consistent with this theory with $\alpha \sim 11$. D_2 values are not available for the other solutes. Overhauser and Lazarus have developed different theories relating the rates of diffusion of solvent atoms within the disturbed regions to the interatomic forces. Both theories predict effects much smaller than observed, except that Overhauser's is in fair agreement with the results for Cu and Pb additions. (auth)

3867 SO-2039

General Electric Research Lab.

FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY. TWENTY-FIFTH QUARTERLY REPORT. (PROGRESS REPORT NO. 42). J. H. Hollomon and D. Turnbull. Apr. 5, 1955. 8p. Contract W-31-109-Eng-52. (RL-1291)

Rates of grain-boundary diffusion have been measured in boundary directions both perpendicular (\perp) and parallel (\parallel) to the dislocation pipes. The ratio of the rates p_{\parallel}/p_{\perp} is about 100 at a boundary misorientation $\theta = 16^\circ$. At $\theta = 28^\circ$, $p_{\parallel}/p_{\perp} \sim 5$, and at $\theta = 45^\circ$ some rate anisotropy remains, p_{\parallel}/p_{\perp} being about 2. At $\theta = 28^\circ$ the activation energy for p_{\perp} is about 7 kcal/g-atom larger than for p_{\parallel} . Results are reported for the effect of thallium additions on the rate of self-diffusion of silver. Data are reported on the heat and

free energy of formation of liquid Ag-Au alloys as a function of composition. The specific heat of high-purity graphite has been measured down to $T = 1.3^{\circ}\text{K}$. (For preceding period see SO-2037.) (auth)

3868 WADC-TR-53-84

Illinois Univ.

[CERAMICS, COMPONENTS, [AND] POWER PLANT AIR-CRAFT]. THE EFFECT OF CERAMIC COATINGS ON THE OXIDATION AND THE IMPACT STRENGTH OF VARIOUSLY HEAT TREATED TITANIUM SPECIMENS. W. J. Plankenhorn, Basil Ohnysty, and Dwight G. Bennett. Feb. 1953. 23p. Contract AF33(616)-320. (AD-12019)

The application of refractory ceramic coatings to commercially pure Ti(Ti-75A) was shown to offer definite advantages. The coating furnished protection against oxidation at temperatures up to and including 1700°F . The degree of protection was determined by the weight increase measured for uncoated and coated specimens variously heat-treated. The effect of varied heat treatments on the metallurgical structure of the metal was studied. Equiaxed α Ti crystals persisted with rapid heating to and air-quench cooling from either 1550 or 1675°F . A similar condition existed after slow heating to and cooling from 1550°F . A needle-like structure with a Widmanstatten arrangement resulted when the specimens were slowly heated to 1675°F and slowly cooled from that temperature. Heating for short periods of time at 1550 and 1675°F resulted in an increase in impact strength for the base metal. Increasing the time of heating at these temperatures or heating at higher temperatures produced embrittlement. Ceramic coatings tended to reduce the rate at which embrittlement progressed. (auth)

3869 WADC-TR-53-274

Allegheny Ludlum Steel Corp.

[HIGH TEMPERATURE ALLOYS; AIRCRAFT STEELS]. CASTING AND FORGING TURBINE BUCKET ALLOYS. R. K. Pitler and W. W. Dyrkacz. Dec. 1953. 70p. Contract AF 18(600)-149. (AD-26352)

Alloys with low strategic alloy content were investigated for gas turbine application at temperatures of 1200 to 1600°F . Wrought Ni-base Ti and Al hardened alloys were studied for service as buckets in high-thrust jet engines. These were evaluated by standard and notched stress-rupture tests at 1350, 1500, and 1600°F on heat-treated bar stock forged from 8000-g induction melts. Satisfactory hot workability was obtained with alloys with 3% Ti and 0.5 to 1% Al. Addition of 10% Co gave properties superior to those obtained with an Ni or Ni-Fe base. Mo additions in excess of 5% resulted in superior strength and ductility. Austenitic steels with 17% Mn and 12% Cr showed promise as a possible material for turbine wheel rims operating at 1200°F . Investment-cast test bars of Fe-Ni-Co-Cr alloys were evaluated for stress-rupture at 1500 and 1600°F and for room-temperature tensile properties. One alloy (F-88) had rupture properties similar to those of AMS 5385A, which is used for nozzle vane applications. The F-88 alloy failed as a nozzle because of low rupture strength. Additions of B to the alloys markedly increased the strength but lowered room-temperature tensile ductility. B-containing heats were remelted from master heats with fair success. (auth)

3870 WADC-TR-54-222

Dow Chemical Co.

[METALLIC MATERIALS]. FUNDAMENTAL STUDY OF

NATURAL AND SYNTHETIC FILMS ON MAGNESIUM AND ITS ALLOYS. Aug. 1954. 167p. Contract AF 33(038)-16655.

Techniques for the study of films which are formed on magnesium during surface treatments or corrosion are described. Among the techniques described are electrical resistance measurements on isolated films and on surface-treated electrodes during aqueous exposures, anodic polarization studies on magnesium alloys in inhibited electrolyte systems, and the microstructural study of surface treatment and corrosion films. Many of the properties of a film become understandable when the microstructural details of the film are known. Thus the hardness and abrasion resistance of the Dow No. 14, Dow No. 17, and H.A.E. films are related to their partial vitrefication during the anodic treatment. By way of contrast, the Dow No. 7 film is a thin, smooth layer of a hydrous gel. Because of its structure it is susceptible to electrolytic permeation and to dehydration. Inadequacies in the protective abilities of the hydroxide films on magnesium stem from the spontaneous exfoliation of these films. Chromate ion inhibits the corrosion of magnesium by engendering the formation of a film which does not exfoliate. (auth)

3871 WADC-TR-54-357

Rensselaer Polytechnic Inst.

MAGNESIUM SHEET ALLOYS. R. R. Nash, H. K. Adams, Jr., A. E. Bibb, Jr., E. J. Tulloch, and M. C. Huffstutler. Nov. 1954. 145p. Contract AF 33(616)-439.

Tentative optimum procedures to add chromium, antimony, strontium, barium, calcium, and manganese to AZ31 base alloy are described. Relative recoveries of additions of chromium, strontium, and barium were extremely low. Recoveries of antimony, calcium, and manganese approached the intended additions. These additions were made singly and in combination to determine their influence on the mechanical properties and resistance to corrosion of AZ31 alloy. The most promising combination of mechanical strength and ductility was associated with alloys containing single additions of chromium and additions of chromium and manganese together in the as-fabricated by hot rolling condition and after cold rolling a controlled amount followed by a stress relieving heat treatment. Compared with AZ31 alloy on the basis of the same conditions of mechanical working and heat treatment, this combination of mechanical properties was a small but definite improvement. The relative resistance to corrosion of AZ31 alloy was lowered by additions of chromium, barium, strontium, and antimony and improved by manganese additions above a nominal 0.3%. This behavior was related, tentatively, to the iron content of the experimental alloys. (auth)

3872 YE54-530

Metallurgical Labs., Sylvania Electric Products, Inc. PLASTIC FLOW AND RECRYSTALLIZATION OF TITANIUM. QUARTERLY PROGRESS REPORT NO. 3 [FOR] SEPTEMBER 1, 1953 TO NOVEMBER 30, 1953. L. L. Seigle, F. D. Rosi, L. Sama, and A. J. Opinsky. Jan. 19, 1954. 11p. Contract AF33(616)-422. (AD-27568)

The mechanism of plastic flow was investigated in coarse-grained specimens of sponge and iodide Ti at -196 , 500, and 800°C . Slip and twinning behavior were the same in arc-melted sponge and in iodide Ti. Slip occurred predominantly on the $\{10\bar{1}0\}$ prismatic planes from -196 to 800°C ; secondary slip on the $\{10\bar{1}1\}$ pyramidal planes in-

creased at high temperatures. Increased deformation by twinning occurred at low temperatures. Tensile and notched impact tests were made on hot rolled and annealed Ti-75A alloy. The presence of H appeared to increase the impact strength above 200°C although the material was brittle at room temperature and below. Grain size had a relatively minor effect on the fracture properties of H-free Ti. Growth velocity measurements were made on recrystallized grains in arc-melted sponge Ti specimens which were strained 2%. At 800°C the rate of growth was 8×10^{-6} cm/sec with an induction period of about 2 hours. (ASTIA abst.)

3873 YE54-541

Metallurgical Labs., Sylvania Electric Products, Inc.
PLASTIC FLOW AND RECRYSTALLIZATION OF TITANIUM. QUARTERLY PROGRESS REPORT NO. 4 [FOR] DECEMBER 1, 1953 TO FEBRUARY 28, 1954. L. L. Seigle, F. D. Rosi, L. Sama, and A. J. Opinsky. Apr. 1954. 18p. Contract AF33(616)-422. (AD-30562)

Although small amounts of hydrogen have a detrimental effect on the mechanical properties of titanium at low temperatures, it appears that the presence of hydrogen tends to raise both strength and ductility in commercial titanium at room temperature and above. Anomalies were found in the stress-strain curves of hydrogen-containing titanium which have not yet been explained. It has been determined by microscopic examination that the cleavage plane of hydrogen-embrittled titanium is the same as the hydride habit plane {1010}. Rates of growth of recrystallized grains in arc melted sponge titanium strained 2% have been completed at 750, 775, 825 and 850°C. The activation energy for grain growth was determined to be 52,000 calories per mol. (auth)

3874 AEC-tr-2115

THE USE OF ELECTROLYTIC POLISHING FOR THE REMOVAL OF LAYERS OF METALS AND ALLOYS FOR THE DETERMINATION OF DIFFUSION COEFFICIENTS. M. B. Neiman (Heiman) and A. Ya. Shinyaev. Translated by S. J. Rothman from *Doklady Akad. Nauk S.S.R.* 96, 315-18(1954). 7p.

3875 AERE-Lib/Trans-457

INVESTIGATION OF THE DIFFUSION OF ZINC IN SILVER-ZINC ALLOYS WITH ADMIXTURES. M. Butsyk and S. Gertsiken. Translated by V. Beak from *Zhur. Tekh. Fiz.* 20, 428-30(1950). 3p.

The influence of the admixtures Au, Ga, Sn, Sb, Al, and In upon diffusion of Zn from a Ag-Zn alloy was studied. The influences of the valency of the third element, Au, Ga, Sn, and Sb on the process of diffusion and the role played by the atomic number of the admixture, using Al, Ga, and In, in the process of diffusion were observed. (J.E.D.)

3876

EQUATION OF STATE OF METALS FROM SHOCK WAVE MEASUREMENTS. John M. Walsh and Russell H. Christian (Los Alamos Scientific Lab., N. Mex.). *Phys. Rev.* 97, 1544-56(1955) Mar. 15.

Shock wave pressure magnitudes from about 150 to 500 kilobars have been attained for metals by using high explosives. A photographic technique for the nearly simultaneous determination of shock and free surface velocities is presented, and measurements for aluminum, copper, and zinc are given. Expressions are derived which permit the calculation of pressure-compression points from measured

velocity pairs. Consequent Hugoniot curves are presented, probable errors for which are 1 to 2 percent in compression for a given pressure. Finally, the known Hugoniot curves are employed in a calculation which determines temperatures and isotherms. (auth)

3877

STUDY OF THE RADIATION STABILITY OF AUSTENITIC TYPE 347 STAINLESS STEEL. M. B. Reynolds, J. R. Low, Jr., and L. O. Sullivan (Knolls Atomic Power Lab., Schenectady, N. Y.). *J. Metals* 7, 555-9(1955) Apr.

The effect of neutron bombardment upon the stability of type 347 austenitic stainless steel has been investigated by a magnetic technique. The relation of the ferrite content of a stainless steel to its magnetic properties is given, and an apparatus suitable for the measurement of the ferromagnetic saturation induction of small specimens is described. Results of measurements on irradiated specimens are tabulated. Exposure to a neutron flux was found to cause a slight increase in the ferrite content of type 347 stainless steel, the change increasing with increasing length of exposure and with increasing initial ferrite content. The similarity of the effect of irradiation to the effect of annealing is pointed out. Possible effect of irradiation upon density of austenitic stainless steel is discussed. (auth)

3878

SOME NEW INTERMETALLIC COMPOUNDS WITH THE "β-WOLFRAM" STRUCTURE. S. Geller, B. T. Matthias, and R. Goldstein (Bell Telephone Labs., Inc., Murray Hill, N. J.). *J. Am. Chem. Soc.* 77, 1502-4(1955) Mar. 20.

The preparation and structures of the intermetallic compounds Nb₃Sn, Nb₃Os, Nb₃Ir, Nb₃Pt, Ta₃Sn, and V₃Sn, with β-W structures, are reported. (L.T.W.)

3879

A UNIVERSAL POLISHING METHOD. H. S. Cannon (Linde Air Products Co., Tonawanda, N. Y.). *Metal Progr.* 67, No. 4, 83-6(1955) Apr.

A basic metal-polishing technique using alumina abrasives is outlined. Materials with as widely divergent properties as lead, brass, steel, cast iron, and cemented carbides can be polished with only slight modifications of the basic technique. (C.W.H.)

3880

BETTER STEEL CASTING FOR HIGH-TEMPERATURE PLANT. W. Siegfried and F. Eisermann (Sulzer Bros., Ltd., Winterthur, Switzerland). *Metal Progr.* 67, No. 4, 100-1(1955) Apr.

Heat-treated mild steel castings with low chromium and molybdenum, used in high-pressure steam boilers and turbines, have been improved by vanadium additions, and their tendency toward notch sensitivity has been corrected by minor amounts of nickel and copper. (auth)

3881

ELECTROPLATING ON MAGNESIUM. H. K. DeLong (Dow Chemical Co., Midland, Mich.). *Metal Progr.* 67, No. 4, 102-8(1955) Apr.

A complete procedure for electroplating on magnesium is described. This procedure includes surface conditioning, activating, zinc immersion coating, copper plating, and subsequent plating (using standard procedures) of magnesium. (C.W.H.)

3882

HOW STAINLESS STEELS RATE FOR HIGH TEMPERA-

TURE AIRCRAFT SERVICE. PART I. E. A. Loria (Crucible Steel Co. of America, Pittsburgh, Penna.) Iron Age 175, No. 14, 119-22(1955) Apr. 7.

The requirements of steel subject to prolonged aerodynamic heating to high temperatures are discussed. High-temperature properties of stainless steels (AISI 422, 422M, and HNM) are reported. (C.W.H.)

3883

HOW CHROMIUM STEELS RATE FOR HIGH-TEMPERATURE AIRCRAFT SERVICE. PART II. E. A. Loria (Crucible Steel Co. of America, Pittsburgh, Penna.). Iron Age 175, No. 15, 103-106(1955) Apr. 14.

Studies in the requirements of steel subject to aerodynamic heating to high temperatures are continued. High-temperature properties of the chromium steels (Halcomb 218 and Chro-Mow) are reported. (For preceding report, see Iron Age 175 No. 14, 119-22 (1955) Apr. 7.) (C.W.H.)

3884

RATE OF FORMATION ON FILM OF METALS AND ALLOYS. G. P. Chatterjee (Univ. of Calcutta, India). J. Appl. Phys. 26, 363-5(1955) Apr.

The rate of atmospheric corrosion of Cu-Zn and Cu-Mg alloys is retarded by Al or Mn, and the law of the growth of film in the case of Cu-Zn alloys changes over from the parabolic to the logarithmic law on the addition of Al or Mn. For Cu-Mg alloys under a given set of conditions the law of the growth of film is governed by $x^{1/2} = k_1 \log t + k_2$, where x is the film thickness, t is time, and k_1 and k_2 are constants. It has been indicated that some experimental data on the corrosion of metals and alloys may be quantitatively represented if two or more functions, representing different mechanisms of the growth of film, are taken into consideration simultaneously. (auth)

3885

CUBIC TO ORTHORHOMBIC DIFFUSIONLESS PHASE CHANGE. EXPERIMENTAL AND THEORETICAL STUDIES OF AuCd. D. S. Lieberman, M. S. Wechsler, and T. A. Read (Columbia Univ., New York). J. Appl. Phys. 26, 473-84(1955) Apr.

A theoretical analysis of the cubic to orthorhombic transformation is presented which predicts for a partly transformed crystal, the interface plane, orientation relationships, and macroscopic distortions from a knowledge only of the lattice parameters of the initial and final phases. Arguments are advanced to show that in order to minimize the strain energy associated with the transformation, the interface plane must be one of zero average distortion. This leads directly to considerations of an inhomogeneous product phase. Experimental studies on an AuCd alloy are described and the observed crystallographic features of the transformation compared with values calculated using the theory. The agreement between calculated and observed results for this alloy system as well as others is strong evidence for the theory of diffusionless phase transformations presented. (auth)

3886

NOTE ON SELF-DIFFUSION OF NICKEL. H. Burgess and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). J. Appl. Phys. 26, 491-2(1955) Apr.

Self-diffusion coefficients of Ni were measured from 250 to 1250°C, employing thin platings of Ni⁶³. At 1000°C, the diffusion coefficient is $1.5 \times 10^{-12} \text{ cm}^2 \text{ sec}^{-1}$ and the activation energy lies in the range 61,000 to 65,000 cal/mole. At about 650°C there occurs a knee in the lnD vs. 1/T plot and

at the lower temperatures the activation energy is between 10,000 and 15,000 cal/mole. (L.M.T.)

3887

THE SURFACE AREAS OF EVAPORATED METAL FILMS. B. M. W. Trapnell (Physical Chemistry Lab., Oxford, England). Trans. Faraday Soc. 51, 368-70(1955) Mar.

Surface areas per unit weight of Ni, Fe, Rh, Mo, Ta, and W films prepared in two different ways have been measured. From these, fractions of the total evaporated atoms present in the films surfaces are calculated. These fractions are shown to be determined mainly by the melting point of the metal, but to some extent by the sintering caused by radiant heat from the evaporating filament. (auth)

PHYSICS

3888 AD-16978

Polytechnic Inst. of Brooklyn

HIGH VALUE INSULATORS. QUARTERLY PROGRESS REPORT NO. 8 COVERING THE PERIOD APRIL 1, 1953 TO JUNE 30, 1953. J. Steigman, R. Brill, L. Arond, A. Bender, R. Corth, and J. Goodman. July 27, 1953. 44p. Contract DA-36-039-Sc-15327.

Resistance measurements on samples of commercial polystyrene sheets were made using the Wheatstone bridge. The apparatus for counting radioactive CO₂ was modified. Polystyrene films, irradiated in air, were shown by IR studies to contain oxygenated irradiation products. Polystyrene powder, irradiated in air and in vacuum, reacted to a greater extent with diphenylpicrylhydrazyl than did unirradiated samples. The sample irradiated in vacuo gave results similar to the air-irradiated sample. The optical density of benzene solutions of chromophore-containing polystyrene varies with time, but the use of methyl isobutyl ketone eliminated this effect. Irradiation of colored polystyrene in air produced marked changes in the absorption characteristics of the polymer. Large x-ray dosage (in air) resulted in complete destruction of the chromophore group. Comparable dosages in vacuo produced little change in the absorption characteristics of colored polystyrene. Thermal degradation of commercial and chromophore-containing polystyrene in air resulted in polymers having absorption spectra similar to commercial and colored polystyrene which had been subjected to extensive x irradiation. When polystyrene film containing butter yellow was irradiated in air, the butter yellow was destroyed. Colored polymethyl methacrylate was produced by thermally polymerizing methyl methacrylate in the presence of the dye p-dimethylamino-p'-diazocyanideazo-benzene. Dry degassed n-butyl chloride was irradiated and then analyzed for total chloride production. IR spectra were taken of some of the irradiated samples. (ASTIA abstr.)

3889 AD-28234

Polytechnic Inst. of Brooklyn

HIGH VALUE INSULATORS. FINAL REPORT COVERING THE PERIOD JULY 1, 1951 TO SEPTEMBER 30, 1953.

J. Steigman, R. Brill, L. Arond, A. Bender, R. Corth, and J. Goodman. Oct. 31, 1953. 65p. Contract DA-36-039-Sc-15327.

Measurements of the resistance of polystyrene and unplasticized polyvinyl chloride were made with a Wheatstone

bridge and checked by a capacitance discharge method. A combustion and gas counting technique was superior to the scintillation counting technique for measuring the radioactivity of C¹⁴-tagged polystyrene. IR spectra of polystyrene irradiated in air revealed the presence of carbonyl groups. The irradiated polystyrene reacted more rapidly with diphenylpicrylhydrazyl than did unirradiated polymer. In irradiation experiments greater destruction of chromophore was obtained with nonaromatic methyl methacrylate polymer than with polystyrene. Butter yellow was only slightly degraded in benzene and cumene, but a much larger breakdown occurred in cyclohexane. Irradiation of butter yellow in polystyrene revealed a greater degradation of chromophore than did colored polystyrene. The silver chromate method was satisfactory for measuring small quantities of chloride produced in the irradiation of alkyl chlorides. A free-radical chain mechanism appeared to produce HCl in the irradiation of BuCl. Quantitative measurements showed an initial high rate of chloride production followed by a constant, lower rate for most of the reaction. (ASTIA abst.)

3890 COO-148

Illinois Inst. of Tech.

INVESTIGATION OF IMPERFECTIONS IN SOLIDS.

PROGRESS REPORT. Theodore J. Neubert and George M. Nichols. Mar. 31, 1955. 30p. Contract AT(11-1)-90.

The order-disorder transition in Ag₂HgI₄ is being studied by means of precision conductivity measurements. Samples are prepared from powdered Ag₂HgI₄ by pressing into discs or casting in sealed glass tubes. Measurements are made on a capacitance-conductance bridge. Electrical contact is made to the sample through a graphite 3-electrode cell, which is shielded and immersed in a thermostated water bath. Results are presented in the form of graphs, showing electrical conductivity as a function of temperature, capacitance as a function of frequency at various temperatures, specific susceptance as a function of temperature, and change in resistance with time after various changes in temperature. Plans for future work are summarized. (For preceding period see COO-146.) (M.P.G.)

3891 MCC-1023-TR-67

Delaware Univ.

SURFACE PHENOMENA RELATED TO THE BORON HYDRIDES. (thesis). Harold Seymour Veloric. June 1955. 82p. [For Olin Mathieson Chemical Corp. Contract NOas 52-1023-c].

A general investigation of the surface phenomenon related to diborane and pentaborane is reported. A series of fifteen active surfaces were investigated with four phases of work predominating: the activation of the surface, the adsorption properties of the surface as a function of temperature and pressure, heterogeneous decomposition at higher temperatures, and thermodynamic functions related to adsorption. The compounds of low reactivity include platinum black, Rb on carbon, Harshaw Co. catalyst, amorphous carbon, Al₂O₃, TiO₂, and 5% Pd on alumina. The more reactive compounds are listed in the order of decreasing activity. All surfaces adsorb if the temperature is low enough; a convenient reference temperature and pressure are selected. Two reaction constants are included, one for the surface reaction and the other for the high-temperature decomposition. (auth)

3892 NBS-3992

National Bureau of Standards

THE STATISTICAL THERMODYNAMICS OF ISOTOPE EFFECTS. III. THE EQUATION OF STATE OF THE HYDROGEN ISOTOPES. Abraham S. Friedman and Irwin Oppenheim. Mar. 15, 1955. 7p.

The isotope effect on the compressibility factors of the hydrogen isotopes has been computed from an expansion of the quantum mechanical partition function in powers of \hbar^2 . The compressibility factor differences between H₂ and HD, D₂, HT, DT, and T₂ are evaluated for temperatures between 40 and 150°K over a wide density range. (auth)

3893 NBS-4005

National Bureau of Standards

THE STATISTICAL MECHANICAL CALCULATION OF THE DATA OF STATE OF THE HELIUM ISOTOPES AT INTERMEDIATE TEMPERATURES AND DENSITIES.

Abraham S. Friedman and Irwin Oppenheim. Apr. 1, 1955. 6p.

The isotope effect on the compressibility factors of the helium isotopes has been computed from an expansion of the quantum mechanical partition function in powers of \hbar^2 . The compressibility factor differences between He⁴, He³, and He⁶ are evaluated over a wide temperature and density range. (auth)

3894 NRL-4420

Naval Research Lab.

DYNAMICS OF LINEAR ELASTIC STRUCTURES. [INTERIM REPORT]. Ralph E. Blake and Eloise S. Swick. Oct. 7, 1954. 27p.

The equations for the response of linear elastic structures to dynamic loading are derived by using only the mathematical methods familiar to most engineering graduates. The differential equations describing the response of a linear elastic structure subjected to a load are seen to be similar to the equation of a simple oscillator subjected to a similar load. Duhamel's Integral is applied to the problem in order to determine the response of linear elastic structures to various types of excitations. Responses are obtained for step and impulse type loadings as well as for general forces. A general equation is obtained for the response of a linear elastic structure to an applied force. This equation is further extended to account for a distributed force; that is, for a load which is distributed over a large area of the structure instead of being applied at a point of the structure. The response of an elastic structure to a shock motion of its foundation is developed. The expression for the stress at a point is derived and it is seen that the shock spectrum is the best available measure of the severity of a shock because the shock spectrum shows the effect of the shock motion on the stress. (auth)

3895 NRL-4506

Naval Research Lab.

THERMAL CONDUCTIVITY OF MERCURY. C. T. Ewing, R. E. Seibold, J. A. Grand, and R. R. Miller. Mar. 17, 1955. 11p.

The thermal conductivity coefficients of high-purity mercury have been measured from 150 to 540°C with longitudinal heat flow apparatus. The vapor pressure varied greatly over this range (less than atmospheric to over 25 atmospheres). However, an increase from 8 to 22 atmospheres in pressures at one temperature showed no change

in the conductivity coefficients. The coefficients over the given range vary from 0.101 to 0.136 watts/cm² °C/cm. Lorentz values, while fairly constant, are somewhat higher than the theoretical values. Values of conductivity for the two sections of stainless steel bar used in the measuring unit gave values more widely separated than was contemplated. (auth)

3896

THE CONSTRUCTION AND CALIBRATION OF A 100-CURIE GAMMA IRRADIATOR. A. Charlesby and O. Flint (Atomic Energy Research Establishment, Harwell, Berks, England). *Atoms* 6, 100-7, 120(1955) Apr.

Construction details and calibration information are presented for a 100-c Co⁶⁰ irradiator. Experimental flux distribution as determined by chemical dosimetry agrees well with the expected theoretical flux distribution.

(C.W.H.)

3897

ADSORPTION OF MIXTURES OF He³ AND He⁴. Mark G. Inghram (Argonne National Lab., Lemont, Ill.) and Earl Long and Lothar Meyer (Univ. of Chicago, Ill.). *Phys. Rev.* 97, 1453-6(1955) Mar. 15.

The distribution of He³ between the vapor phase and dilute mixtures of He³ in He⁴ adsorbed on jewellers' rouge (Fe₂O₃) has been measured between 1.6 and 2.3°K, for saturations in the range 15 percent to 99 percent, corresponding to film thicknesses of 1.3 to 34 layers. The ratio of the mole fraction of He³ in the vapor phase to that in the adsorbed phase is practically independent of the thickness of the adsorbed film, and essentially the same as for the bulk liquid case. The onset of superfluidity in the adsorbed films does not influence the He³ concentration in samples taken by simple desorption techniques. (auth)

3898

MEASUREMENTS AND COLLISION—RADIATION DAMAGE THEORY OF HIGH-VACUUM SPUTTERING. Frank Keywell (Univ. of Southern California, Los Angeles). *Phys. Rev.* 97, 1611-19(1955) Mar. 15.

A brief summary of some of the important experimental and theoretical work related to the subject of metallic sputtering is presented. The need for measurements in high vacuum is indicated and an ion beam which utilized a Philips Ion Gauge discharge ion source to make high-vacuum sputtering ratio measurements is described. Absolute sputtering ratio data for the gas-metal combinations Ag-Kr, Ag-A, Ag-Ne, Ag-He, Cu-Kr, Cu-A, Pb-A, and Pb-He are presented in terms of the number of atoms sputtered per incident ion, n_s, versus incident ion energy, E₀, for ion energies varying between 400 to 6100 ev. The data are interpreted by treating the incident ion as a hard sphere which "cools" in a manner similar to a neutron losing energy by collisions in a lattice, each collision producing recoil atoms and atomic displacements near the surface. The number of atoms escaping, or "sputtering," from the metallic surface is reduced from the number displaced by absorption within the metal which is accounted for by a parameter α . By use of elementary neutron cooling theory and the Seitz formula for displacements produced by a recoil atom within a solid, the formula for the number of atoms sputtered per incident ion is given for the case of ions more massive than the metallic atoms. The effect of ions rebounding from the surface after the first collision is considered to produce effectively two types of incident current particles; (1) incident gas ions and (2) recoil metal

atoms. These considerations lead to a modified sputtering ratio formula, which reduces to the above equation when M₁ ≥ M₂. The displacement energy for the process, E_d, is calculated by use of G. K. Wehner's data on sputtering thresholds and the relation E_t = E_d/ε. A fair fit to the experimental data is obtained by suitable choice of α in the modified formula for the cases studied. The use of "hard" collisions is justified and an equivalent ion energy shift defined by equal average energy transfer on the first ion-atom collision is applied to the data. The subject of sputtering thresholds is treated by an attempt to bracket observed thresholds, E_t, between limits defined by the atomic heat of vaporization, the displacement energy, and the average energy transfer per collision. (auth)

3899

IONIZATION IN PURE GASES AND THE AVERAGE ENERGY TO MAKE AN ION PAIR FOR ALPHA AND BETA PARTICLES. William P. Jesse and John Sadauskis (Argonne National Lab., Lemont, Ill.). *Phys. Rev.* 97, 1668-70(1955) Mar. 15.

Results of measurements of W, the energy required to produce an ion pair by Ni⁶³ and H³ beta particles in pure gases, are presented for several gases and comparison made with corresponding α particle values. A cylindrical ionization chamber was used, employing a gridded electrode. Measurements of current were made by a method previously described (*Phys. Rev.* 77, 782(1950)). (C.W.H.)

3900

INFLUENCE OF SYMMETRY EFFECTS ON THE THERMAL EXCITATIONS OF LIQUID ³He AND ⁴He. J. De Boer and E. G. D. Cohen (Institute for Theoretical Physics, Univ. of Amsterdam, Netherlands). *Physica* 21, 79-80 (1955) Jan. (In English)

Symmetry effects in liquid He³ and He⁴ are discussed by means of a modified Lennard-Jones cell model. Two types of thermal excitations are defined, collective excitations and cell-excitations. The necessary symmetrization of the wave function for the pairs of molecules in each of the cell clusters affects the entropies and the molar spin-susceptibilities of the helium isotopes. (C.W.H.)

3901

PORTABLE, REMOTE-CONTROLLED RADIOGRAPHIC-SOURCE UNIT. Victor E. Ragosine and Carl D. Sarine (Sprague Electric Co., North Adams, Mass.). *Nucleonics* 13, No. 4, 60-2(1955) Apr.

A portable container for a 10-c Ir¹⁹² source, which can be constructed by using the hydraulic cylinder and pump designed for automobile-window operation, is described. (L.M.T.)

3902

MODERN PHYSICS FOR THE ENGINEER. Louis N. Ridenour, ed. New York, McGraw-Hill Book Co., Inc., 1954. 499p.

3903

PROPERTIES OF ELASTIC AND PLASTIC WAVES DETERMINED BY PIN CONTACTORS AND CRYSTALS. Stanley Minshall (Los Alamos Scientific Lab., N. Mex.). *J. Appl. Phys.* 26, 463-9(1955) Apr.

Experimental techniques are described by which one can observe the separation of a shock wave in a metal into an elastic wave and a slower plastic wave. The plastic-wave velocity was about 15 percent less in steel and 10 percent

less in tungsten than the elastic-wave velocity, at pressures imparted by Composition B explosive. Elastic-wave velocities were the same, within experimental error, as the measured sound velocities. The pressure in the elastic wave in SAE 1020 steel, deduced from the material and wave velocities, is independent of the plastic-wave pressure within experimental accuracy, and is about 12 kilobars. SAE 1040 steel, however, does not exhibit a single characteristic elastic-wave pressure. The pressure initially is about 6 kilobars, and increases to about 12 kilobars before the arrival of the plastic wave. (auth)

AEROSOLS

3904 AD-44577

Georgia Inst. of Tech. Engineering Experiment Station INVESTIGATION OF FACTORS DETERMINING AGGREGATION OF FINE-PARTICLE MATTER. QUARTERLY REPORT NO. 3. Clyde Orr, Jr., Mendel T. Gordon, and Jane B. Garrett. Mar. 14, 1954. 32p. Contract DA-18-064-CML-2379.

Conditions under which aerosols aggregate and the nature of the cohesive forces, electrical or other, which influence aggregation were investigated. Aerosols of Serratia marcescens, rubber latex, alumina, and clay were studied. Data are presented on the effects of light, humidity, electrical charge, aerosol age, mechanical deaggregation, and antistatic agents on the clumping rate of aerosols. (C.H.)

COSMIC RADIATION

3905 AEC-tr-2109

ANGULAR DISTRIBUTION OF COSMIC RAY PARTICLES IN THE STRATOSPHERE. S. N. Vernov and A. M. Kulikov. Translated by E. R. Hope from Doklady Akad. Nauk S.S.R. 61, 1013-15(1948). 3p.

Measurements were undertaken on the angular distribution of cosmic rays in the stratosphere. It was demonstrated that in the passage of cosmic rays through the atmosphere the direction of the primary particles is closely maintained, and the secondary particles can deviate only to small angles from the direction of the primary particles. It was concluded that primary cosmic rays consist not only of positively charged particles but also of negatively charged particles. (C.W.H.)

3906

COSMIC RADIATION. II. W. Galbraith (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 6, 109-16, 120(1955) Apr.

The properties of the primary particles and their secondary generations in the atmosphere and the nuclear interactions of the various particles in matter are discussed. (Part I appears in Atomics 6 (1955) Feb.) (C.W.H.)

3907

PROTON COMPONENT OF COSMIC RADIATION AT AN ELEVATION OF 3200 METERS ABOVE SEA LEVEL. N. M. Kocharyan (Physics Inst., Academy of Sciences, Armenian S.S.R.). Zhur. Ekspl'i. i Teoret. Fiz. 28, 160-70(1955) Feb. (In Russian)

The momentum spectrum of protons in the 0.4 to 2 Bev/region was measured. The absorption range of the protons in air and Pb was determined, and the spectrum of proton production in Pb was investigated. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3908 AEC-tr-2110

PLASTICITY, HARDENING, AND RECRYSTALLIZATION. R. Becker. Translated by Cyrus Feldman from Z. tech. Phys. 7, 547-55(1926). 12p.

The technological properties of metals can be interpreted qualitatively by supplementing the lattice theory of crystal physics with the concept of thermal fluctuations in potential, lattice defects, and changes of position among atoms. The connection between these phenomena and the above-mentioned technological properties is discussed in detail. (auth)

ELECTRICAL DISCHARGE

3909

LONGITUDINAL OSCILLATIONS OF PLASMA. I. A. A. Luchina (Moscow State Univ.). Zhur. Ekspl'i. i Teoret. Fiz. 28, 17-27(1955) Jan. (In Russian)

3910

LONGITUDINAL OSCILLATIONS OF PLASMA. II. G. Ya. Myakishev and A. A. Luchina (Moscow State Univ.). Zhur. Ekspl'i. i Teoret. Fiz. 28, 28-37(1955) Jan. (In Russian)

GASES

3911 AEC-tr-2106

CHEMICAL PHYSICS SERIES. VOL. 9. BOOK I. IMPERFECT GASES. Taro Kihara. BOOK II. CONDENSATION PHENOMENA. Yoshio Muto. [Manuscript completed, 1948]. [Published by] Asakusa Bookstore. 125p. (F-TS-7083-RE)

A detailed theoretical treatment of various characteristics of imperfect gases is presented in book form. In the first part of the book (Chapter I to Chapter III), the characteristics of the gases in thermodynamic equilibrium are explained on the basis of statistical dynamics; in the second part of the book (Chapter IV to Chapter VIII) the characteristics of gases not in thermodynamical equilibrium and the transmission phenomena of imperfect gases are discussed. (C.W.H.)

INSTRUMENTS

3912 AERE-EL/R-1536

Atomic Energy Research Establishment, Harwell, Berks (England)

ELECTRONIC COMPONENT FAILURES AT HARWELL JANUARY-JUNE 1953. R. L. Elliott. Oct. 21, 1954. 36p.

A detailed study of electronic component failures is described. A fault list showing numbers and types of components that caused equipment failures is included. Over 80% of the reported failures were from obsolete types. Therefore, statistics showing total failure of each type of component are no guide to the reliability of up-to-date components unless the results are qualified by details of the faulty samples. (M.P.G.)

3913 LA-1878

Los Alamos Scientific Lab.

THE MODEL 250 AMPLIFIER. C. Wilkin Johnstone. Feb. 1955. 25p. Contract W-7405-Eng-36.

The Model 250 amplifier was designed for use with scintillation detectors. It is a linear amplifier of moderate gain and speed, capable of withstanding a very large over-

load factor. A description of the circuit and a discussion of the operating characteristics and limitations of the amplifier are included. The advantages of the Model 250-A amplifier are also described. (auth)

3914 NAA-SR-Memo-1107

North American Aviation, Inc.

USE OF THE INSTRON TENSILE TESTING MACHINE TO OBSERVE RESISTANCE RECOVERY. Herman M. Dieckamp and Charles J. Meechan. Apr. 15, 1955. 17p. Contract AT-11-1-Gen-8.

The load-measuring circuitry of the Instron Tensile Testing Machine is readily adaptable to applications requiring the continuous recording of a changing resistance. Such an application is the observation of resistivity recovery in cold-worked and irradiated metals. Use of the machine greatly facilitates the recording of isothermal annealing curves and the determination of the activation energy of the recovery. (auth)

3915 NACA-TN-3392

Ames Aeronautical Lab., NACA

TWO MINIATURE TEMPERATURE RECORDERS FOR FLIGHT USE. John V. Foster. [Feb. 2, 1955]. 13p.

The description and characteristics of two small temperature recorders suitable for flight use are given. Both recorders were designed for use with thermocouples. Both operate on the null-balance principle which allows their measurements to be essentially independent of change of thermocouple lead resistance. One recorder is of the electro-mechanical follow-up, self-balancing potentiometer type. This instrument is a self-contained recorder of quite high accuracy. The unit has provision for an expanded scale and a remote visual indicator. The other instrument described achieves self-balance by means of an electronic feedback amplifier. The feedback current, which is proportional to the thermocouple voltage, is recorded on an external recording oscillograph. This unit has reasonable accuracy and a very fast time response. (auth)

3916

MEASURING INSTRUMENT FOR MAGNETIC FIELDS UTILIZING THE MAGNETIC RESONANCE OF THE PROTON. N. I. Leont'ev. Zhur. Ekspl't. i Teoret. Fiz. 28, 77-84(1955) Jan. (In Russian)

ISOTOPES

3917

RADIOACTIVE ^{69}As AND ^{70}As . F. D. S. Butement and E. G. Prout (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 46, 357-8(1955) Mar.

The determination of a new neutron deficient isotope of arsenic, As^{69} , is described. Radioarsenic was obtained from germanium dioxide which had been irradiated with protons of energies from 8 to 60 Mev. Between 20 and 30 Mev, a new 15 min activity appeared due to a ($p,2n$) reaction on Ge^{70} . The mass assignment of the 15 min activity to As^{69} was made by milking off and identifying the radioactive Ge daughter. As^{69} emitted positrons, the maximum energy of which was determined to be 2.9 Mev. A single γ ray with an energy of 0.23 Mev was found. The γ -ray spectrum of 52-min As^{70} was also examined. (M.P.G.)

MASS SPECTROGRAPHY

3918 AD-46196

Arkansas Univ. Engineering Experiment Station

DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT NO. 11 [FOR THE PERIOD] JULY 1, 1954 TO SEPTEMBER 30, 1954. Oct. 25, 1954. 18p. Contract AF 33(616)-15.

Progress is reported in the development of a mass spectrometer designed for the instantaneous analysis of gas mixtures. Construction details of a five-stage mass spectrometer tube, methods for operation of the tube, a block diagram of circuits associated with the five-stage mass spectrometer, and data on performance of the five-stage tube are included. (For preceding period see AD-46197.) (C.H.)

3919 AD-46197

Arkansas Univ. Engineering Experiment Station

DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT NO. 10 [COVERING THE PERIOD] APRIL 1, 1954 TO JUNE 30, 1954. 22p. Contract AF 33(616)-15.

Progress is reported in the development of a mass spectrometer designed for the instantaneous analysis of gas mixtures. A mathematical analysis is presented of the three-, four-, and five-stage analyzers for use in the mass spectrometer tube. (For preceding period see AD-32605.) (C.H.)

3920 AERE-GP/R-1449

Atomic Energy Research Establishment, Harwell, Berks (England)

A MASS SPECTROMETER FOR THE ISOTOPIC ANALYSIS OF HYDROGEN CONTAINING A LOW CONCENTRATION OF DEUTERIUM. P. Reynolds. Aug. 1954. 24p.

A mass spectrometer suitable for the comparison of isotope ratios in samples of hydrogen gas containing only a low concentration of deuterium is fully described. High stability of the measured isotope ratio for a sample is achieved, so that in the region of concentration of 0.015 mole % D samples can be compared for their deuterium content to a precision of ± 0.00007 mole % D. (auth)

MATHEMATICS

3921

NOTE ON THE THEORY OF MASS BEHAVIOR. John Z. Hearon (Oak Ridge National Lab., Tenn.). Bull. Math. Biophys. 17, 7-13(1955).

A differential equation has been derived by A. Rapoport, Bull. Math. Biophysics, 14, 159(1952), giving the time course of the fraction of the population who have performed a given act. The general solution of this equation is obtained, some properties of the solution are deduced, and a special case presented in detail. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

3922 AD-9828

Polaroid Corp.

RADIACMETER IM-56(1)/PD. FINAL REPORT.

William A. Shurcliff. Jan. 29, 1953. 39p. Contract NOBsr-49193.

Radiacimeters (KBr dosimeters) were produced which can be used almost anytime, in any place, to determine if the cumulative exposure to γ -radiation is less than 100 r, between 100 to 300 r, or greater than 300 r. A visual determination is made by comparing 2 blue-colored comparison steps with a sensitized KBr crystal. The studies showed that a sensitized KBr crystal can be used successfully as the sensitive element in a personal dosimeter for the 0- to 600-r range. The radiacimeter (type 98) use is limited by the fact that it does not distinguish between doses in the range below 100 r, and by the fading of the crystal's blue color which occurs when the device is exposed to daylight for 0.5 hr. A pilot plant for sensitizing 50 to 100 crystals at a time was designed, built, and successfully operated for a month. The Type 98 device can be erased and then used over again. (See also AD-12 224) (ASTIA abst.)

3923 CRLIR-158

Chemical and Radiological Labs., Army Chemical Center
THE DEVELOPMENT OF A RADIOACTIVE SOURCE FOR
A TRAINING AID. INTERIM REPORT. James C.
Kerrigan. Aug. 14, 1952. 19p. (ATI-168642)

The development of a radioactive training aid source for the U.S. Army is described which will be used primarily for the calibration of survey instruments. The objective was to design the source with its associated container and handling device, taking cognizance of low cost and ease of manufacture with a view toward standardization. The training aid consists of an encapsulated and standardized radioactive Co⁶⁰ source of 80 to 120 mc, a cylindrical lead shield which is permanently fastened in a $\frac{1}{4}$ -in. plywood carrying case, and a mechanical remote-control handling device. (auth)

3924 CVAC-255T

Consolidated Vultee Aircraft Corp.
CALIBRATION OF STANDARD 50 CC AND 900 CC
IONIZATION CHAMBERS. C. F. Malone and V. M. Davis.
Mar. 8, 1954. 31p. Contract AF33(038)-21117. (MR-N-34)

The calibration of eight 50-cc and eight 900-cc ionization chambers and their related electrometers is described. Data charts are included which show electrometer readings as functions of electrode voltage changes, percent collection of ions as a function of field strength, electrometer response—a function of pressure in the ion-chamber, directional properties of ionization chambers, and dose rate as a function of source-detector separation distance. (L.M.T.)

3925 DP-110

DuPont de Nemours, E. I., and Co. Explosives Dept.
Atomic Energy Div.
SRP SCINTILLATION COUNTERS. C. A. Prohaska.
Mar. 1955. 22p. Contract AT(07-2)-1.

The operating characteristics of the SRP Standard Gamma Scintillation Counter and the SRP Special Alpha Scintillation Counter were investigated. Results on both counters are essentially the same. Plateaus are over 200 volts long, with a slope of approximately 1% per hundred volts. Reproducibility is satisfactory, but the background is high. The coincidence correction is less than one per cent per 10^5 counts per minute. (auth)

3926 DP-111

DuPont de Nemours, E. I., and Co. Explosives Dept.
Atomic Energy Div.
MINIATURE ION CHAMBER FOR HIGH GAMMA FIELDS.

A. C. Lapsley. Mar. 1955. 12p. Contract AT(07-2)-1.

A miniature ion chamber was developed to measure gamma fields from 10^4 to 10^8 r/hr. Its sensitivity is 10^{-13} amps per r/hr. It may be operated under water and in high-flux nuclear reactors at temperatures up to 500°C. (auth)

3927 HW-33122

Hanford Works

TWO TECHNIQUES FOR FAST NEUTRON DETECTION
USING THE S³²(n,p)P³¹ REACTION. R. L. Tomlinson.
Jan. 12, 1955. 22p. Contract W-31-109-Eng-52.

Two methods of utilizing sulfur powder as a fast flux detector are described, and relative counting efficiencies of the two methods are shown. Self-absorption characteristics of elastomeric foils containing varying amounts of irradiated sulfur have been determined as well as geometry corrections for use in beta counting sources whose diameters are greater than that of the Geiger Muller counting tube. (auth)

3928 LA-1835

Los Alamos Scientific Lab.

GENERAL HANDBOOK FOR RADIATION MONITORING.
Robert F. Barker, comp. and ed. Sept. 1954. 91p.
Contract W-7405-eng-36.

Safety policies, equipment, and procedures used for the decontamination of personnel and equipment at the Los Alamos Scientific Laboratory are outlined. Constants and conversion factors, a glossary of terms, a table of isotopes, permissible exposure data, and photographs of equipment are included. (C.H.)

3929 MLM-871

Mound Lab.

GAMMA RADIATION FROM POLONIUM NEUTRON
SOURCES. (INFORMATION REPORT). M. R. Hertz and
R. J. Breen. July 17, 1953. 28p. Contract At 33-1-
Gen-53.

A NaI (Tl) crystal scintillation spectrometer was used to investigate the gamma spectrum from polonium-alpha bombardment of Li, Be, B, F, Na, Mg, and Al. The principal gamma energies observed are: Li, 0.483 Mev; Be, 4.45 Mev; B, 3.68 and 2.36 Mev; F, 1.28 and 1.51 Mev; Na, 1.83 and 2.57 Mev; Mg, 1.20, 1.82, and 4.0 Mev; Al, 1.25, 2.28, and 3.55 Mev. The probable origin of the gamma radiation is described. A comparison of experimental neutron spectrum curves with a calculated curve shows a value of 0.7 γ/n for a Po-Be source. (auth)

3930 NP-5576

Tracerlab, Inc.

DEVELOPMENT REPORT FOR SLOW NEUTRON SURVEY
EQUIPMENT [FOR] PERIOD NOVEMBER 30, 1952 TO
DECEMBER 31, 1952. (PHASE 1). Richard Bersin. Apr.
1, 1953. 14p. Contract NObsr-57440.

In any portable radiation detection instrument the usual measurement procedure is to average the interaction properties of the radiation field. For direct current operation an average is taken of the number of interactions, which is then interpreted as an indication of the average effect assuming equal effects per interaction. For the measurement of health hazards, the former system is in general more satisfactory. However, in the very special case where the quality of the radiation field remains invariable, but only its intensity varies, the latter system is equally desirable. A brief description of several readily available circuits is presented. (auth)

3931 NP-5577

Tracerlab, Inc.

DEVELOPMENT REPORT FOR SLOW NEUTRON SURVEY EQUIPMENT [FOR] PERIOD DECEMBER 31, 1952 TO JANUARY 31, 1953. (PHASE 1). Richard Bersin. Apr. 1, 1953. 8p. Contract NObsr-57440.

Various available photomultiplier tubes and crystal scintillator combinations are described in the light of detecting neutrons and gamma radiation. (auth)

3932 NYO-3782

Bausch and Lomb Optical Co.

IRRADIATION DAMAGE TO GLASS. Norbert J. Kreidl and Gerald E. Blair. Mar. 21, 1955. 21p. Contract AT(30-1)-1312.

A system of high-level dosimetry (of high energy radiation) utilizes the absorption changes of glasses measured on a suitable spectrophotometer. Calibration has been accomplished over the range of 1.5×10^3 to 4.1×10^6 rep. (auth)

3933 RDB(W)/TN-118

Division of Atomic Energy (Production), Research and Development Branch, Windscale (England)

A PORTABLE ALPHA MONITOR. G. Bottomley. Jan. 1954. 9p.

A description is given of a portable battery-driven alpha monitor having a sensitivity comparable with the 1021 mains operated monitor. The monitor is constructed in two parts, an air proportional counter with amplifier and a ratemeter. For gross indication purposes, the counter can be used separately from the ratemeter, monitoring being by earphones. (auth)

3934 RDB(W)/TN-119

Research and Development Branch, Industrial Group, Windscale Works, Dept. of Atomic Energy, Windscale, Cumb. (England)

A FAST NEUTRON MONITOR. D. D. McLeod. Jan. 1954. 12p.

The characteristics of a methane-filled proportional counter, exposed to simultaneous fast neutron and gamma radiation, are presented. The counter is shown to give adequate sensitivity for measurements of fast neutron dose rates with good discrimination against gamma radiation. (auth)

3935 RM-1359(RAND)

RAND Corp.

COMPUTATION OF RADIATION LEVEL IN THE VICINITY OF A DISTRIBUTION OF CONTAMINATING MATERIAL.

R. H. Frick. Sept. 30, 1954. 30p.

This paper presents the results of an analytical investigation of the radiation field in the vicinity of various distributions of radioactive material. The analysis considers only the radiation level due to unscattered γ radiation and in the most general case considered, equations are developed for the radiation from an infinite slab of contaminated material of thickness h_c shielded from the observer by an uncontaminated layer of thickness h_o . Several special cases of the general equation are presented which should be useful in the determination of the effectiveness of various decontamination methods as well as in the evaluation of the protection afforded by underground shelters from the γ radiations emanating from radioactive fall-out. (auth)

3936 UCRL-4474

Radiation Lab., Univ. of Calif., Livermore

SCINTILLATOR POTTING. Jerry H. Zenger. Mar. 17, 1955. 5p. Contract W-7405-eng-48.

The potting of NaI and LiI crystals in Al cylinders with end windows of glass and Al foil is accomplished in a dry box arrangement. (K.S.)

3937 USNRDL-TR-22

Naval Radiological Defense Lab.

A GAMMA DISCRIMINATING BETA SURVEY METER.

Walter F. Joseph and Richard M. Bond. Nov. 18, 1954. 24p.

This compact beta survey meter measures beta contamination directly. With a known beta to gamma ratio, local gamma can be measured in a high, general contamination region. The meter is available in these ranges: 0 to 20, 0 to 200, 0 to 2000, 0 to 20,000 μ c, equivalent to 0 to 0.2, 0 to 2, 0 to 20, 0 to 200 μ c/sq cm. The 0 to 20 μ c is usable in gamma fields of 0.1 r, etc. In the two-section ion chamber, each section gamma-sensitive and having opposite voltages, the gamma outputs cancel. The lower part is beta sensitive, and the beta is applied to the input of an electrometer circuit. (auth)

3938 USNRDL-TR-25

Naval Radiological Defense Lab.

CYCLOTRON NEUTRON AND GAMMA-RAY DOSIMETRY FOR ANIMAL IRRADIATION STUDIES. E. Tochilin, S. W. Ross, B. W. Shumway, G. D. Kohler, and R. Golden. Nov. 1, 1954. 48p.

By means of sulfur threshold detectors and nuclear track plates, physical measurements were made of the neutron flux density and spectrum emitted from a thick beryllium target when bombarded with 20-Mev deuterons. Using the neutron spectrum and a first collision dose curve for tissue, the rep dose was determined (1 rep was obtained for 1.9×10^8 neutrons per sq cm). An evaluation of the associated gamma-ray dose from the target and from the cyclotron indicated that in regions where animals were exposed the gamma-ray dose was less than 10% of the neutron dose. Depth dose measurements using sulfur and gold detectors and ionization chambers were made in a water phantom. The resultant curves were similar for depths greater than 3 in., indicating that the degraded neutron spectrum had approached equilibrium. Depth dose curves obtained with ionization chambers showed good agreement with a published theoretical curve for 10-Mev neutrons. (auth)

3939

THE RANGE-ENERGY RELATION IN NUCLEAR EMULSIONS. R. R. Daniel, E. C. George, and B. Peters (Tata Inst. of Fundamental Research, Bombay, India). Proc. Indian Acad. Sci. A41, 45-8(1955) Feb.

An empirical range-energy curve for protons up to 2-Bev energies was constructed from values calculated by the Princeton Physics Department. The curve was based on the finding that available experimental range-energy data for emulsions which have equal moisture content are directly related to the corresponding theoretical values for Al and Pb calculated by the Princeton group. (C.W.H.)

3940

ASSAY OF BREATH CARBON-14 DIOXIDE OF HUMANS USING IONIZATION CHAMBERS. Elton M. Baker, B. M. Tolbert, and M. Marcus (Univ. of California, Berkeley).

Proc. Soc. Exptl. Biol. Med. 88, 383-6(1955) Mar.

An apparatus for the physical separation and purification of CO₂ from human breath is described. These CO₂ samples have been measured in a series of ionization chambers varying from 100 to 1500 cc. The optimum sample size was found to be 1000 cc for these unshielded-atmospheric pressure ionization chambers. With such equipment it is possible to carry out experiments in humans with as little as one microcurie of carbon-14. (auth)

3941

NUCLEAR PARTICLE DETECTION: FAST ELECTRONICS. R. E. Bell (Chalk River Lab., Canada and McGill Univ., Montreal, Canada). Ann. Rev. Nuclear Sci. 4, 93-110(1954).

Advances in fast circuit design ($\sim 10^{-10}$ sec.) are reviewed. Applications are considered largely in connection with scintillation detectors. The review includes a survey of amplifier design, pulse-height analysis, and coincidence techniques. (K.S.)

3942

CHARACTERISTICS OF SCINTILLATORS. Robert K. Swank (Argonne National Lab., Lemont, Ill.). Ann. Rev. Nuclear Sci. 4, 111-40(1954).

This review is concerned with the development, theory, and applications of organic and inorganic scintillators. The discussion is concerned primarily with the scintillator itself and with the scintillations produced in it by high-energy particles. 78 references. (L.T.W.)

3943

ČERENKOV COUNTERS. John Marshall (Univ. of Chicago). Ann. Rev. Nuclear Sci. 4, 141-56(1954).

The characteristics and design of various types of Cherenkov counters are reviewed. The types of counters discussed include nonfocusing counters, gas Cherenkov counters, the Getting-Dicke focusing counter, and focusing counters employing a cylindrical mirror. 32 references. (L.T.W.)

3944

THE MEASUREMENT OF PHOTONEUTRON YIELDS WITH A SODIUM IODIDE CRYSTAL. K. G. McNeill (Univ. of Glasgow). Phil. Mag. (7) 46, 321-6(1955) Mar.

It is shown that a NaI (Tl) crystal will act as a detector of photoneutrons by virtue of the production of radioactive I¹²⁸ within the crystal. This detecting technique has been applied to the comparison of the photoneutron yields obtained from copper, cadmium, mercury, and lead when these elements are irradiated with a bremsstrahlung X-ray beam of maximum energy of 22 Mev. The yields from these four elements are found to be in the ratios Cu : Cd : Hg : Pb as 1:4.1:9.5:8.4. (auth)

3945

A METHOD FOR THE PREPARATION OF THIN FILMS OF PLUTONIUM AND URANIUM. K. M. Glover and P. Borrell (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 214-17 (1955) Feb.

Fission counters and foils uniformly coated with plutonium and uranium are required for nuclear measurements. A technique is described in which the plutonium or uranium is dissolved in a cellulose lacquer. This lacquer is painted on to the foils and the fission counters are coated by dipping them into this solution. (auth)

3946

INTENSITY MEASUREMENTS OF COSMIC NEUTRONS IN

WATER AT GREAT DEPTHS. Edmond M. Binggeli (Univ. of Lausanne, Switzerland). Helv. Phys. Acta 28, 3-23 (1955) Feb. (In French)

Nuclear emulsions containing B or Li salts, surrounded by paraffin and enclosed in sealed brass cylinders, were exposed in the waters of Lake Léman for 7 months at depths of 12, 102, 202, and 302 m. The fading of the Li emulsions was such that the average life of the latent tracks was about 500 days. The neutron fluxes produced by cosmic radiation, measured by the two emulsions, are in agreement and are given by $\Phi_p = \Phi_0 \exp(-\gamma P)$, where P is in meters of H₂O, $\Phi_0 = 38 \pm 13$ neutrons/cm²·j, and $\gamma = (5.4 \pm 0.4)\%$, corresponding to mean free path $\lambda = 185 \pm 15$ m of H₂O. (tr-auth)

3947

SOME LITHIUM IODIDE PHOSPHORS FOR SLOW NEUTRON DETECTION. K. P. Nicholson and G. F. Snelling (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys. 6, 104-6 (1955) Mar.

An account is given of the growing of single crystals of lithium iodide for use as scintillation detectors of slow and resonance energy neutrons. Tin, europium and samarium activators have been tested and their relative merits are presented. Where possible the phosphor properties are compared with a standard sodium iodide crystal. The practical application of lithium iodide crystals to neutron counting and the limitations imposed by their sensitivity to γ -radiation are discussed. (auth)

3948

ELECTRONICS IN AUTOMATIC DIRECT READING SPECTROMETERS FOR THE ANALYSIS OF METALS. F. Holmes (Hilger and Watts, Ltd., London). J. Brit. Inst. Radio Engrs. 15, 163-76(1955) Mar.

After first discussing the fundamentals of photoelectric spectrometry, the basic essentials of automatic direct reading instruments are reviewed, reference being made to a 3-meter direct reading spectrometer with 30 channels which has been developed as a rapid routine production control unit in the making of non-ferrous alloys. The circuit employs features not previously used in this type of equipment, including a "dekatron" counter circuit and a printing recorder to register the counts corresponding to the intensity ratios of the selected spectral lines of the constituent elements being measured. The concentrations are then determined from working curves established experimentally for each measuring channel to give the concentration as a function of the count for the corresponding element. (auth)

3949

A-N₂ FILLINGS MAKE ION CHAMBERS INSENSITIVE TO O₂ CONTAMINATION. U. Facchini and A. Malvicini (Laboratori CISE, Milan, Italy). Nucleonics 13, No. 4, 36-7(1955) Apr.

Quick chamber filling is feasible with A-N₂ mixtures, because up to 1/2% O₂ contamination can be tolerated. This is true because electron energies are kept in the region of low O₂ electron-capture cross section. (auth)

3950

USING BREMSSTRAHLUNG DETECTION BY A SCINTILLATOR FOR SIMPLIFIED BETA COUNTING. Robert Loewinger and Sergei Feitelberg (Mount Sinai Hospital, New York). Nucleonics 13, No. 4, 42-5(1955) Apr.

This method of assaying correlates counter efficiency with the theory of electromagnetic radiation emission by β emitters. Liquid samples can be counted without preparation, and when 1- to 5-ml samples are used, accuracies comparable to G-M counting are obtained. (auth)

3951

INTERCOMPARISON OF FAST-NEUTRON DOSIMETERS.

H. H. Rossi, G. S. Hurst, W. A. Mills, and H. E. Hungerford, Jr. (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 4, 46-7(1955) Apr.

Comparison tests of tissue-equivalent ionization chambers and recoil proportional-counter dosimeters are discussed. The tissue-equivalent chamber gave neutron doses 5 to 15% greater when the two instruments were compared simultaneously with a variety of neutron sources. (L.M.T.)

3952

INCREASING FLUORESCENCE EFFICIENCY OF LIQUID-SCINTILLATION SOLUTIONS.

Milton Furst, Hartmut Kallmann, and Felix H. Brown (New York Univ.). Nucleonics 13, No. 4, 58-9(1955) Apr.

In a previous article (*Phys. Rev.* 97, 583(1955)) it was shown that for many solutions the addition of sizable amounts of appropriate substances (e.g. naphthalene) effectively produces a new solvent that transfers the primary absorbed energy to the solute more effectively than does the original solvent—and often more effectively than solvents formed by adding xylene on phenylcyclohexane. This paper is concerned with applications of this enhancement method to boron- and water-containing solutions. (auth)

3953

EFFECT OF BODY BACKSCATTER IN GAMMA-RAY PERSONNEL DOSIMETRY.

Leonard R. Solon and Hanson Blatz (Atomic Energy Commission, New York). Nucleonics 13, No. 4, 62-4(1955) Apr.

Film badges and pocket dosimeters are usually calibrated in free air, but under actual field conditions are worn on the person. The experiment described here shows that these differences between calibration and field conditions make no practical difference in dose calibration. (auth)

MESONS

3954 UCRL-2858

Radiation Lab., Univ. of Calif., Berkeley

PION PRODUCTION BY NEUTRONS ON HELIUM

(thesis).

Peter Hill Moulthrop. Jan. 31, 1955. 46p. Contract W-7405-eng-48.

A He-filled 36-atmosphere diffusion cloud chamber in a pulsed 21,000-gauss magnetic field was operated in the 300-Mev neutron beam of the 184-in. cyclotron. The relative yields of the processes leading to negative pion production were determined from 295 observed events. Energy and angular distribution data are presented. A simple phenomenological interpretation of the cross sections is proposed. (auth)

3955

STUDY OF CHARGED HEAVY UNSTABLE COSMIC RAY PARTICLES.

P. R. Barker, D. M. Binnie, B. D. Hyams, and R. J. Rout (Univ. of Manchester). *Phil. Mag.* (7) 46, 300-6(1955) Mar.

A technique for the direct counter detection of heavy unstable cosmic ray particles stopping in a cloud chamber

is described. It is shown that the method is about 3 times more efficient than methods previously used when detecting particles with lifetimes greater than 5×10^{-9} sec. The observation of 8 well-identified unstable particles is reported. All have properties consistent with the K_u particle. (auth)

3956

MEASUREMENTS OF THE LIFETIMES OF CHARGED HEAVY UNSTABLE PARTICLES.

P. R. Barker, D. M. Binnie, B. D. Hyams, and R. J. Rout (Univ. of Manchester). *Phil. Mag.* (7) 46, 307-10(1955) Mar.

A new counter method for measuring the lifetime of unstable mesons is described. Lifetime measurements on 13 charged heavy mesons are reported. It is concluded that if there exists only one heavy meson giving fast decay products, with a lifetime greater than 5×10^{-9} sec, its lifetime is $(11.0 \pm 4.1) \times 10^{-9}$ sec. No evidence for any longer-lived heavy mesons has been found. (auth)

3957

HEAVY MESONS.

C. Dilworth, G. P. S. Occhialini, and L. Scarsi (Univ. of Milan, Italy and Univ. of Brussels, Belgium). *Ann. Rev. Nuclear Sci.* 4, 271-314(1954).

Since the present knowledge of heavy mesons is limited by a lack of coherence in the observation and measurements, the first section of the review is devoted to a critical survey of the experimental framework in which the results assembled in later sections must be considered. The entire gamut of heavy particles, including T mesons and S, V, and K particles, is discussed. 66 references. (L.M.T.)

3958

FORMATION OF MESONS AT NEAR-THRESHOLD ENERGY.

A. B. Migdal. *Zhur. Eksptl'. i Teoret. Fiz.* 28, 10-12(1955) Jan. (In Russian)

Expressions for the energy spectrum of mesons formed by collision of two nucleons are derived. A relation is derived between the cross section for formation by deuterons (in the reactions $p + p = n + p + \pi^+$, $n + p = p + n + \pi^0$, and $n + n = n + p + \pi^-$) and the cross section for formation by free neutrons and protons with parallel spins. (G.Y.)

3959

PROBABLE IONIZATION BY μ MESONS IN GAS IN THE MOMENTUM INTERVAL 2×10^8 TO 1.2×10^{11} ev/c.

V. A. Lyubimov, G. P. Eliseev, V. K. Kosmachevskii, and A. V. Kovda. *Doklady Akad. Nauk S.S.R.* 100, 883-6 (1955) Feb. 11. (In Russian)

3960

NUCLEAR INTERACTIONS OF K-MESONS.

R. R. Daniel and D. Lal (Tata Inst. of Fundamental Research, Bombay, India). *Proc. Indian Acad. Sci.* 41A, 15-24 (1955) Jan.

Fast K mesons (τ as well as K_w mesons) with energies between 150 and 250 Mev can cause nuclear disintegrations and lose a substantial fraction of their kinetic energy without losing their identity. The character of the interaction in three of the four cases discussed here exhibits a remarkable degree of similarity. The nuclear capture of a K-meson at rest is discussed. The nature and distribution of prongs in the capture star suggest that a Λ^0 -hyperon may have been formed during the capture process. (auth)

3961

EVIDENCE FOR THE CHARGED θ -MESON.

M. V. K. Appa Rao and S. Mitra (Tata Inst. of Fundamental Re-

search, Bombay, India). Proc. Indian Acad. Sci. 41A, 30-5(1955) Jan.

A K meson is found to decay at rest into a nearly relativistic secondary particle. The secondary particle produces a nuclear disintegration in flight and is identified as a π -meson of kinetic energy ~ 110 Mev. The event is interpreted as the decay of a θ^\pm -meson according to the scheme: $\theta^\pm \rightarrow \pi^\pm + \pi^0 + (222 \pm 12)$ Mev. (auth)

MICROWAVES

3962 AERE-GP/R-1479

Atomic Energy Research Establishment, Harwell, Berks (England)

DIELECTRIC MEASUREMENTS IN THE 3cm WAVE-LENGTH REGION. P. E. Redmill and P. S. Rogers. Dec. 3, 1954. 24p.

Measurements have been made of the electrical properties of some ceramic materials suitable for use as output windows of high-power microwave signal generators. The measurements were made a wavelength of 3.2 cm and followed a resonant cavity method. The relative permittivity and loss tangent of samples of high-strength aluminum oxides have been determined. (auth)

NEUTRONS

3963 AERE-T/R-1500

Atomic Energy Research Establishment, Harwell, Berks (England)

MULTI-GROUP THEORY WITH AN APPLICATION TO INELASTIC SCATTERING IN URANIUM. M. E. Mandl. Aug. 1954. 13p.

A multi-group theory is given for systems where energy losses covering more than one energy group can occur at single collisions, e.g. by inelastic scattering or by elastic scattering in hydrogenous mixtures. Several different types of boundary conditions are considered and the system need not be self-critical. The theory is illustrated by applying it to calculating the energy spectra at various distances from a point source in a large block of natural uranium. (auth)

3964 AERE-T/R-1523

Atomic Energy Research Establishment, Harwell, Berks (England)

NEUTRON PRODUCTION BY ELECTRON BOMBARDMENT OF URANIUM. M. B. Biram. Oct. 1954. 13p.

An attempt is made to calculate the number of neutrons produced per electron, when a monoenergetic beam of electrons is allowed to fall on a thick uranium target. A Monte Carlo process is used to determine the spectrum of γ rays in the target as a result of primary processes. The effect of secondary processes is then calculated from this information. Initial electron energies between 30 and 40 Mev are considered. (auth)

NUCLEAR PHYSICS

3965 CU-134

Nuclear Physics Labs., Columbia Univ.

PROGRESS REPORT FOR OCTOBER, NOVEMBER AND DECEMBER 1953 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 37p. Contract AT-30-1-GEN-72.

The slow neutron transmission of CCl_4 was investigated to determine the neutron cross section of chlorine. The

chlorine cross section is given by $\sigma = 15.0 + 6E - \frac{1}{2}$, which is to be compared with 3 barns obtained from the formula $4\pi (1.5 \times 10^{-3} A^{1/3})^2$. This implies the existence of a negative level having appreciable resonance scattering. The vertical position of the beam in the 36-in. Pupin cyclotron has been observed and found to be below the geometric median plane for radii greater than 8 in. This change in vertical beam position is caused by a change in the position of the magnetic median plant. The first harmonic of the azimuthal variation of the magnetic field has been reduced from 0.41 to 0.02% at 14 in. by proper shimming. An investigation of β energies has been carried out to see if any other nucleus besides Cl^{34} displays the anomaly of inversion of T values for low lying states. None was found. A useful formula for coulomb energy differences of isobars ($Z, Z' = Z-1$) was found to be ΔE (Mev) = $1.4 Z'/A^{1/3} - 0.6$. A method for analyzing two pulse height distributions which are close together is described. An automatic sample changer system providing 8 sample stations has been constructed. A very stable BF_3 counter using monel metal parts has been constructed. A technique for construction of copper BF_3 counters is described. The technique of using spheres of scintillating plastic as scintillation detectors for slow neutrons has been further developed. The spectrum of $18\text{-min } Br^{40}$ was investigated with the solenoid spectrometer. A gamma ray of 620 ± 10 kev was found with $N\gamma/N\beta = 0.12 \pm 0.02$. The negatron spectrum was consistent, with analysis into two groups having end points separated by ~ 600 kev. The positron spectrum was found to have an allowed shape with end point of 862 ± 10 kev and $N\beta^+/N\beta^- = 0.04 \pm 0.005$. The composite β -spectrum of K^{42} has been investigated in the magnetic coincidence spectrometer. It is found that the contribution of the B_{11} term, from theory based on single tensor interaction, is not large. An effect due to angular dependence of annihilation radiation from the magnetic substates of orthopositronium has been observed. The fraction (f) of orthopositronium decaying by 3 quantum annihilation is found to be $\frac{2}{3}$, however, the angular dependence of the radiation from the $m = 0$ substate is found to be effected by a strong magnetic field resulting in an $f < \frac{2}{3}$. The ratio of singlet to triplet decay rates, λ_s/λ_t was found to be 1290 to an accuracy of $\sim 14\%$. The beta spectrum resulting from the reaction $A^{35} \rightarrow Cl^{35} + \beta + \gamma$ has been investigated at Brookhaven to find if this material will be suitable to determine the coefficients G_s and G_v from a neutron beta ray angular correlation experiment. (For preceding report in series see CU-131.) (auth)

3966 UCRL-2920

Radiation Lab., Univ. of Calif., Berkeley

PHYSICS DIVISION QUARTERLY REPORT [FOR] NOVEMBER, DECEMBER 1954, JANUARY 1955. Mar. 15, 1955. 43p. Contract W-7405-eng-48.

Successful operation of a 4-in. liquid-hydrogen bubble chamber was achieved in the 5-bev π^- Bevatron beam. The decays of 5 K^+ mesons were observed in a stack of 600- μ emulsions exposed to the secondary particles from a target bombarded by 4.8-bev protons. Preliminary results are reported on the "direct" production of K particles by 5.7-bev protons in a stack of G.5 emulsions. A study of 380-Mev α particle interactions in G.5 emulsions gives a mean free path for star production of 18.4 ± 1 cm. The average number of prongs per star is 3.3. A weak 15 ± 1 -Mev γ ray was observed in the 90-Mev neutron bombardment of C.

The energy spectra of π^\pm mesons by 300-Mev photon bombardment of C, H₂, and D₂ at 90° are reported. Experiments are under way to investigate the resolution of the spiral-orbit spectrometer. Polarization in proton-proton scattering at 170 Mev was measured. Modifications of 184-in. cyclotron r-f system are described, together with a detailed discussion of current design developments for the 60-in. cyclotron. (For preceding report in series see UCRL-2805.) (K.S.)

3967

ANNUAL REVIEW OF NUCLEAR SCIENCE. VOLUME 4. James G. Beckerley, Martin D. Kamen, and Leonard I. Schiff, eds. Stanford, Annual Reviews, Inc., 1954. 483p.

Separate abstracts have been prepared for 16 chapters in this volume.

NUCLEAR PROPERTIES**3968 AD-19917**

Indiana Univ.

SUMMARY REPORT OF THE INDIANA CONFERENCE ON NUCLEAR SPECTROSCOPY AND THE SHELL MODEL [HELD AT] INDIANA UNIVERSITY, BLOOMINGTON, ON MAY 14, 15, 16, 1953. [E. J. Konopinski]. 51p. Contract n6ori-48, Task Order 1.

3969

BETA-SPECTRA OF Ag¹¹⁰ AND Sb¹²⁴. Toshio Azuma (Naniwa Univ., Mozu, Sakai, Osaka, Japan). *J. Phys. Soc. Japan* **10**, 167-72(1955) Mar.

Beta spectra of Ag¹¹⁰ and Sb¹²⁴ have been measured with a double coil, magnetic lens spectrometer of about 2% resolving power and their Fermi plots were studied. For the decay of Ag¹¹⁰, it was found that the soft component of the continuous beta-ray spectrum could be analyzed into three groups of allowed type with end points at 80, 314, and 530 kev. For Sb¹²⁴, five beta-ray groups with end points at 2.39, 1.68, 1.07, 0.63, and 0.28 Mev are found, in which the group of the highest energy is inferred as the first forbidden mixed interaction for ST or VA shape. The results for Sb¹²⁴ agree with other observers. (auth)

3970

THE THERMAL NEUTRON ACTIVATION CROSS-SECTIONS OF U²³⁸ AND Th²³². V. S. Crocker (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* **1**, 234(1955) Feb.

Values of 2.75 ± 0.1 and 7.31 ± 0.12 b for U²³⁸ and Th²³², respectively, were obtained by means of a comparison experiment. (L.M.T.)

3971

RADIOFREQUENCY AND MICROWAVE SPECTROSCOPY OF NUCLEI. G. E. Pake (Washington Univ., St. Louis, Mo.). *Ann. Rev. Nuclear Sci.* **4**, 33-50(1954).

New results on the spin and magnetic moments of stable and unstable nuclei are summarized. Considerable attention is given to recent advances in microwave spectroscopy, particularly the atomic beam detector of Wessel and Lew, and a method for polarizing nuclei proposed by Overhauser and subsequently verified by Carver and Slichter. (K.S.)

3972

NUCLEAR SPIN EXCHANGE IN SOLIDS: Ti²⁰³ AND Ti²⁰⁵ MAGNETIC RESONANCE IN THALLIUM AND THALLIC OXIDE. N. Bloembergen and T. J. Rowland (Harvard Univ., Cambridge, Mass.). *Phys. Rev.* **97**, 1679-98(1955) Mar. 15.

The line width of the Ti²⁰³ and Ti²⁰⁵ nuclear magnetic resonance in thallium and thallium oxide greatly exceeds the dipolar width, and is a function of the abundance of the other isotope. The results can be interpreted in terms of an exchange interaction $A_1 \cdot I_2$ between a pair of nuclear spins which exceeds the normal dipolar interaction. The exchange between different isotopes leads to broadening. Exchange between like nuclei should lead to narrowing, but it was found that samples containing 98.7 percent Ti²⁰⁵ still exhibit lines broader than the dipolar interaction. Two causes are shown to exist: anisotropy of the chemical shift and pseudo-dipolar exchange interaction. Analysis with the method of the moments gives for the exchange interaction constant $Ah^{-1} = 17.5$ kc/sec with a 30 percent anisotropic pseudo-dipolar character in the hexagonal metal, and $Ah^{-1} = 12$ kc/sec with less than 10 percent pseudo-dipolar character in thallic oxide. The oxide has a chemical shift of +0.55 percent with an anisotropy of 34 percent of this amount. The metal exhibits a shift of 1.56 percent with 16 percent anisotropy. Ramsey's theory of the nuclear spin exchange via excited electron states in molecules, is extended to solids. Most heavy isotopes in metals and insulators should exhibit exchange effects. From the anisotropy of the exchange, information about the relative amount of p or d character of the electron wave function in the solid can be obtained. It is predicted that thallic oxide has a nuclear Curie point at 3.5×10^{-6} °K. Whether it will become nuclear ferromagnetic or antiferromagnetic depends on details of the electronic band structure. (auth)

3973

FREE MAGNETIC INDUCTION IN NUCLEAR QUADRUPOLE RESONANCE. M. Bloom (Univ. of Illinois, Urbana) and E. L. Hahn and B. Herzog (Columbia Univ., New York). *Phys. Rev.* **97**, 1699-1709(1955) Mar. 15.

The free precession of an ensemble of nuclear quadrupole moments in an axial electric field gradient is studied by the pulsed nuclear induction method. A quantum-mechanical analysis describes the free precession and spin echo signals which result from the application of single and double pulses of radio-frequency field at the condition of zero-field quadrupole resonance. Beat modulation effects exhibited by free precession signals in a small constant external magnetic field are predicted by analysis. An alternative semiclassical description of quadrupole precession is given, which is analogous to the macroscopic nuclear induction equations of Bloch. Theory is verified by observation of free precession signals of chlorine in NaClO₃. (auth)

NUCLEAR REACTORS**3974 AERE-RP/M-47**

Atomic Energy Research Establishment, Harwell, Berks (England)

THE VARIATION OF POWER IN A FAST REACTOR FOR A LINEAR INCREASE OF REACTIVITY. J. J. Syrett. Aug. 16, 1954. 10p.

An approximate solution is derived for the variation of power in a reactor containing a neutron source in which the reactivity is increasing at a constant rate. It is assumed that all delayed neutron emitters have the same decay constant, and that the prompt neutron lifetime is negligibly small. It is shown for a numerical example that the error due to these assumptions is small. (auth)

3975 BNL-280

Brookhaven National Lab.

THE COMBINED EFFECT OF DELAYED NEUTRONS AND TEMPERATURE ON REACTOR KINETICS. R[obert] S. Margulies. July 1954. 15p.

Certain aspects of the problem of the kinetics of a reactor subject to temperature coefficient and delayed neutrons are considered. The steady state is found and its stability discussed. Some information is obtained concerning the adiabatic case. The problem of kinetic response to a small change in reactivity is considered, and the short and long time behavior of the temperature is discussed. In particular, it is found that, as expected, the delayed neutrons cause a retardation of the initial response. This phase of the work is hampered by the finite radius of convergence of a power series. The reason for the finiteness is explained. The approach to equilibrium is shown to be either a damped sinusoidal oscillation or an exponential decay. Numerical illustrations are given and some aspects of perturbation treatments discussed. Finally, the related problem of small oscillations of a system with constant rate of heat removal is briefly touched upon. (auth)

3976 JENER-32

Joint Establishment for Nuclear Energy Research (Norway) TEMPERATURE MEASUREMENTS IN JEEP. Arne Lundby. 1954. 16p.

Preliminary studies have been made of the thermal characteristics of JEEP. The thermal resistance between uranium and aluminium canning has been found to be rather large in the region of operation. Thus at 250 Kw (about 2.5 watts/cm² heat flowing through the surface of a central uranium rod) the maximum temperature difference is about 90°C. The effects of temperature variations on the kinetic behavior of the reactor have been studied. The temperature coefficients for the uranium and the heavy water have been found to agree with measurements in other laboratories ($\alpha_U = -1.5 \times 10^{-5}$ per °C, $\alpha_{D_2O} = -25 \times 10^{-6}$ per °C). (auth)

3977 NDA-27-39

Nuclear Development Associates, Inc.

DECAY OF FISSION PRODUCT GAMMAS. F. H. Clark. Dec. 30, 1954. 58p. Contract Nonr-1258(00).

The gamma decay of fission products is reviewed. Various times of reactor operation prior to shutdown were considered. For each of these cases, the fission product gammas were distributed into 7 energy groups, and a chart was prepared for each group which shows the energy produced from gamma decay per unit time as a function of time after shutdown. (auth)

3978 NP-5506

North Carolina State Coll.

OBSERVATIONS ON THE METEOROLOGICAL DISPERSAL OF STACK GASES AT THE RALEIGH REACTOR STACK (thesis). James Asbury Downey, III. 1954. 105p.

The dispersal patterns of smoke clouds in the atmosphere, and meteorological conditions affecting the dispersal, were determined for smoke from the stack of the Raleigh reactor. Horizontal and vertical observations were made and the average dispersal index under various conditions is tabulated. On the basis of the tests, recommendations are presented for the discharge of radioactive gases into the atmosphere. (C.H.)

3979

A STUDY OF THE NON-LINEAR KINETICS OF THE CHATILLON REACTOR. I. THEORY. Harry J. Lipkin (Commissariat à l'Energie Atomique, Seine, France). *J. Nuclear Energy* 1, 203-13 (1955) Feb.

The nonlinear dynamics of a heterogeneous reactor is considered by extending the treatment of Weinberg and Ergen. The new features present in the heterogeneous case are discussed, and results and conclusions are obtained for comparison with experiments performed on the Chatillon reactor. (auth)

3980

MEASUREMENTS OF THE VELOCITY DISTRIBUTION OF THE NEUTRONS ESCAPING FROM A THERMAL NUCLEAR REACTOR. J. Pelser (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). *Physica* 21, 22-8 (1955) Jan. (In English)

Measurements on the velocity distribution of neutrons escaping from the jeep reactor are described. The distribution fits very close to a Maxwellian with a temperature of 393°K. (auth)

3981

CALCULATING THERMAL UTILIZATION FOR LARGE THERMAL REACTORS. R. W. Houston (Columbia Univ., New York). *Nucleonics* 13, No. 4, 70-5 (1955) Apr.

The equations presented by Weinberg (Elements of Nuclear Reactor Theory, p. 264 (D. Van Nostrand, New York, 1952)) for estimating thermal utilization, *f*, in an infinite heterogeneous reactor are extended to include the effects of coolant or cladding in the lattice. The results are particularly applicable to gas- or heavy-liquid-metal-cooled reactors. (auth)

NUCLEAR TRANSFORMATION

3982

SPALLATION OF ELEMENTS IN THE MASS RANGE 51-75. S. G. Rudstam (Univ. of Uppsala, Sweden). *Phil. Mag.* (7) 46, 344-56 (1955) Mar.

Empirical formulas for the yields of the products obtained in spallation reactions with high energy particles are constructed. These formulas reproduce most of the experimentally determined cross sections within a factor of 2, and they simplify the comparison between different spallation investigations. (auth)

3983

EXCITATION FUNCTION FOR THE REACTION $^7\text{Li}(\gamma t)^4\text{He}$ UP TO 21 MEV. Mitsuo Miwa (Tokyo Univ. of Education, Japan and Univ. of Illinois, Urbana). *J. Phys. Soc. Japan* 10, 173-5 (1955) Mar.

The excitation function for the $^7\text{Li}(\gamma t)^4\text{He}$ reaction up to 21 Mev has been studied by using betatron bremsstrahlung and nuclear emulsion, the statistics being much better than that of former workers. Resonance peaks were found at the excitation energies of 7.6, 8.6, 9.6, 11.7, (13.5), and 16.2 Mev, 9.6 and 16.2 Mev peaks being the most predominant. The results were in good agreement with those of Titterton and Brinkley in the general trend and the most predominant peaks of the excitation function. (auth)

3984

GAMMA RAYS FROM THE REACTION $^{27}\text{Al}(p,\gamma)^{28}\text{Si}$. Manabu Hattori, Kazuo Hisatake, and Teruo Momota,

Univ. of Tokyo, Japan and Takasi Mikumo, Tokyo Inst. of Tech., Japan). *J. Phys. Soc. Japan* 10, 242-3 (1955) Mar.

The energies of the γ rays from the $\text{Al}^{27}(\text{p},\gamma)\text{Si}^{28}$ reaction were measured by means of photographic emulsions loaded with heavy water. Strong γ rays were found at 4.5, 5.1, 5.7, and 10.7 Mev, and weak γ rays at 6.7, 7.5, 8.3, and 12.1 Mev. (L.M.T.)

3985

THE USE OF THE $^3\text{T}(\text{d},\text{n})^4\text{He}$ REACTION FOR A COMPARISON OF SOME METHODS FOR THE ABSOLUTE MEASUREMENT OF A FAST NEUTRON FLUX. THE YIELD OF A Ra- α -Be SOURCE. Karl-Erik Larsson. *Arkiv Fysik* 9, No. 18, 293-333 (1955).

3986

THE REACTION CROSS SECTION OF $\text{S}(\text{n},\alpha)\text{Si}$ AND $\text{S}(\text{n},\text{p})\text{P}$ FOR NEUTRON ENERGY OF 2.2 TO 4.0 MEV. T. Hürlimann and P. Huber. *Helv. Phys. Acta* 28, 33-48 (1955) Feb. (In German)

The reactions $\text{S}^{32}(\text{n},\text{p})\text{P}^{32}$, $\text{S}^{32}(\text{n},\alpha)\text{Si}^{29}$, and $\text{S}^{32}(\text{n},\alpha)\text{Si}^{28}$, leading to the ground state of P^{32} and the ground and first excited states of Si^{29} , resp., have been studied by use of an ionization chamber filled with SO_2 . Pulses were analyzed by means of a pulse spectrometer. The cross sections for the three reactions are complicated functions of neutron energy. The (n,p) and (n,α) reactions occur with approximately equal frequency, but cross section maxima for the two reactions do not coincide. The ratio $\sigma[\text{S}(\text{n},\alpha)\text{Si}^0]/\sigma[\text{S}(\text{n},\alpha)\text{Si}]$ is much greater than would be expected from Coulomb barrier penetration argument. (auth)

PARTICLE ACCELERATORS

3987 AERE-GP/R-1539

Atomic Energy Research Establishment, Harwell, Berks (England)

NOTES ON COUPLED PILL BOX RESONATORS OPERATING IN THE π -MODE. J. H. Adlam and P. D. Dunn. Oct. 1954. 17p.

A structure made up of coupled pill box resonators and operated in the π -mode has been suggested as being suitable for the acceleration of protons. The optimum design of individual resonators has been discussed elsewhere. Some characteristics of the coupled systems are described here in terms of a lumped circuit equivalent. It is shown that a minimum value of coupling is fixed by considerations of inherent phase error and frequency (temperature) tolerance and is considerably greater than the minimum required for mode spacing. (auth)

3988 AERE-T/M-114

Atomic Energy Research Establishment, Harwell, Berks (England)

LINEAR ACCELERATOR PHASE OSCILLATIONS. J. S. Bell. Oct. 1954. 12p.

The axial motion of a particle in a linear accelerator is analyzed taking account of the detailed distribution of accelerating field. It is shown that the frequency and rate of damping of small phase oscillations do not depend on the details of the distribution. (auth)

3989 NP-5579

Bartol Research Foundation, Franklin Inst.

DEVELOPMENT OF A LINEAR ELECTRON ACCELERATOR AND APPLICATION TO SOLID STATE PROBLEMS. FINAL REPORT. J. F. Marshall and M. A. Pomerantz.

Jan. 31, 1955. [Contains Preprint: Electrical Conductivity Induced in MgO Crystals by 1.3 Mev Electron Bombardment. M. A. Pomerantz, R. A. Shatas, and J. F. Marshall]. 22p. Contract DA-36-034-ORD-1216.

Measurements in the field of solid-state physics and physical electronics made with the Bartol linear accelerator during the period are reviewed briefly. Experimental and theoretical studies on secondary electron bombardment-induced conductivity, the development of basic control and measuring devices for the project, and studies on band-structure of solids, and the role of lattice defects and color centers are discussed briefly. A discussion of the electrical conductivity induced in MgO crystals by 1.3 Mev-electron bombardment is appended. (C.H.)

3990

DETERMINING BETATRON ENERGY BY ACTIVITY RATIOS. Milton Birnbaum, Erich M. Harth, Leo Seren, and Ralph Tobin (Naval Research Lab., Washington, D. C.). *Nucleonics* 13, No. 4, 64-6 (1955) Apr.

Photonuclear activations are frequently used to determine the energy calibration and stability of a betatron. The chief drawback to the method is its dependence on the measurement of x-ray dosage, which is subject to a number of uncertainties. This may be avoided by using as an energy indicator the ratio of the activities of two different samples that were irradiated simultaneously, and for which standard activation curves have been previously determined. (L.M.T.)

3991

RECENT DEVELOPMENTS IN PROTON SYNCHROTRONS. John P. Blewett (Brookhaven National Lab., Upton, N. Y.). *Ann. Rev. Nuclear Sci.* 4, 1-12 (1954).

Important developments in the design of proton synchrotrons during 1952, 1953, and the first 3 months of 1954 are discussed. New principles in accelerator design, including the alternating gradient focusing principle, are enumerated by reference to machines such as the Brookhaven Cosmotron, the Birmingham synchrotron, and the UCRL Bevatron. (K.S.)

3992

HIGH-ENERGY ACCELERATORS. M. Stanley Livingston. New York, Interscience Publishers, Inc., 1954. 157p.

The development of recent high-energy accelerators is reviewed by a discussion of physical, particle orbit, and design principles. The principles are demonstrated by recourse to particular machines. The mathematical analysis of particle motion is presented in a separate chapter, where common features of acceleration, focusing, and stability are derived from the equation of motion. (K.S.)

RADIATION ABSORPTION AND SCATTERING

3993 AD-16225

Bartol Research Foundation, Franklin Inst.

SEMI-ANNUAL REPORT [COVERING THE PERIOD] FEBRUARY 1, 1953-JUNE 30, 1953. I. ELASTIC SCATTERING II. TOTAL CROSS SECTIONS; ANGULAR DISTRIBUTION; INELASTIC CROSS SECTIONS. C. E. Mandville. July 30, 1953. 48p. Contract Nonr 436(00)

Neutrons scattered 90° by a Cr cylinder were detected photographically with the paraffin-wedge technique. An elastically scattered group at about 4 Mev was resolved as well as 2 groups at lower energies corresponding to inelastic scattering and the formation of Cr^{42} in excited

states at about 1.43 and 1.93 Mev. A scattering ring, an NaI-Tl crystal, and neutrons produced in the d-d reaction by the Van de Graaff statitron were used to measure γ rays from inelastic scattering. A discussion is presented of the following γ rays and relative intensities obtained: Fe, 0.85 and 2.15 Mev at 680 and 260; Bi, 0.90, 1.63, and 2.66 Mev at 540, 1000, and 650; Pb, 0.84, 1.55, and 2.66 Mev at 400, 650 and 450; and Cr, 1.43 Mev. The discrepancies are pointed out. Angular distributions were obtained for 3.7-Mev neutrons scattered from Al, Pb, and Fe. Measured total cross sections of 2.55, 3.51, and 7.60 barns were obtained for Al, Fe, and Pb, respectively. The integrated differential cross sections were 1.73, 2.94, and 5.17 barns, respectively. Single and double scattering through the ring scatterer are analyzed in appendixes. (For preceding period see AD-3487.) (ASTIA abst.)

3994 AD-17410

Research Foundation, Ohio State Univ.

THE INELASTIC SCATTERING OF ELECTRONS BY HELIUM. E. N. Lassettre, M. E. Krasnow, and S. Silverman. Jan. 1953. 53p. Contract AF19(122)-642, Scientific Report No. 3.

The angular scattering of electrons which have lost sufficient energy to have excited the 2^1P state of helium has been studied for incident electron energies of 417, 511 and 604 volts over the range of 4 to 15°. Cross sections and generalized oscillator strengths have been calculated and the Born approximation has been shown to give a good description of data in this range of incident electron energies. Energy impact spectra have been obtained for several angles at these voltages and also at 325, 232 and 116 volts. Using these the $1^1S \rightarrow 2^1S$ and $1^1S \rightarrow 2^1P$ transitions have been resolved, and cross sections and oscillator strengths for these transitions have been calculated as a function of the square of the change in momentum on impact of the colliding electron. Similar calculation from the spectra have been performed for transitions to the 3^1P state, the ionization limit, and to a point 9 volts in the continuum. (auth)

3995 AECU-3015

RAND Corp.

POLYNOMIAL APPROXIMATIONS TO NEUTRON-DEUTERON DIFFERENTIAL ANGULAR CROSS SECTIONS. Harold Zirin. June 5, 1953. 18p. For Los Alamos Scientific Lab. Contract [W-7405-eng-36], Subcontract SC-9. (RM-1203-AEC)

An attempt is made to describe experimental measurements of (n,d) angular cross sections in a form suitable for computation. Differential cross sections are approximated by a series of Legendre polynomials with energy-dependent coefficients, and smooth curves are drawn for the coefficients of various energies of incidence. Values of the total cross section for n-d scattering are determined in order to estimate the magnitude of the inelastic n(n,2n)d cross section. (K.S.)

3996 AEC-tr-2119

THEORY OF SCATTERING OF FAST CHARGED PARTICLES. PART II. PLURAL AND MULTIPLE SCATTERING. Gert Molieré. Translated from *Z. Naturforsch.* 3a, 78-97(1948). 30p. Available from Associated Technical Services (Trans. 35G5G), East Orange, N. J.

3997

THE LINEAR EXTRAPOLATION LENGTH AT THE SURFACE OF AN IMPERFECTLY ABSORBING CYLINDER.

R. J. Royston (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 1, 194-9 (1955) Feb.

The neutron density in a non-capturing medium surrounding an imperfectly absorbing, non-scattering cylinder is calculated by the spherical harmonics method in the P_3 approximation. The linear extrapolation length of the asymptotic neutron density is then deduced from this for various absorbing powers of the cylinder. (auth)

3998

ELASTIC SCATTERING OF NEUTRONS BY CARBON IN ENERGY RANGE 1.92 TO 3.84 MEV. R. Budde and P. Huber. *Helv. Phys. Acta* 28, 49-66(1955) Feb. (In German)

The relative differential cross section for elastic scattering of neutrons by carbon has been measured by means of an ionization chamber for neutrons of energy 1.92 Mev to 3.84 Mev. A phase analysis demonstrates the existence of three energy levels in the compound nucleus C^{15} , two of the $D_{\frac{3}{2}}$ type and one for which $l > 1$. At a deuteron energy of 600 kev and at an angle of neutron emission of 45° relative to the direction of the incident deuterons, the degree of polarization of the neutrons is $(18 \pm 7)\%$. The spin orientation of the polarized neutrons is parallel to the vector $[\vec{v}_n, \vec{v}_d]$. When CS_2 vapor was employed as a gas in the ionization chamber, three groups of α particles were observed, corresponding to the reaction $S^{32}(n,\alpha)Si^{29}$ leading to the ground state and the first two excited states of Si^{29} . (auth)

3999

MODERATION OF NEUTRONS IN SiO_2 AND $CaCO_3$. Jay Tittman (Schlumberger Well Surveying Corp., Ridgefield, Conn.). *J. Appl. Phys.* 26, 394-8(1955) Apr.

The spatial distributions of indium resonance neutrons about a "point" Ra-Be source have been measured in pure $CaCO_3$ (limestone) and SiO_2 (sand) out to $r^2 \approx 9\tau$. Both media show nearly Gaussian distributions corresponding to Fermi ages $\tau(SiO_2) = 1906 \pm 90$ cm² and $\tau(CaCO_3) = 461 \pm 23$ cm² over most of the range observed. Excess resonance flux near the source, more pronounced in $CaCO_3$ than in SiO_2 , appears to be due to inelastic scattering although such interpretation is not unambiguous. Space integrals indicate ~10% more absorption in $CaCO_3$ than in SiO_2 during moderation. Data were corrected for 4.5-hr activity, 54-min activation by high energy neutrons, and edge effects; consideration was given to the 3.9- and 9-ev In levels in defining the mean detection energy and to the nonmonoenergetic nature of the Ra-Be source in affecting the shape of the indium resonance spatial distribution. (auth)

4000

RELATION TO DIFFUSION MEASUREMENTS OF SOME BETA-RAY ABSORPTION PHENOMENA. A. E. Berkowitz (Univ. of Pennsylvania, Philadelphia). *J. Appl. Phys.* 26, 403-5(1955) Apr.

The absorption in thin layers of nickel, aluminum, and cobalt of beta rays from Co^{60} was measured in connection with the use of the surface counting method of determining diffusion coefficients. Data were obtained for foils and for evaporated and electroplated layers. In all cases the activity increased between 0 and 4 mg/cm². A discrepancy was noted between the data for foils and those for evaporated and electroplated layers. It is shown that this general behavior is predicted by simple scattering and absorption

expressions. The implications of these data for the use of the surface counting method are discussed. (auth)

4001

THERMALIZATION OF POSITRONS IN METALS. G. E. Lee-Whiting (Chalk River Lab., Ontario, Canada). Phys. Rev. **97**, 1557-8(1955) Mar. 15.

It is shown that a thermalization time of 3×10^{-12} sec follows from the assumption that the interaction between a positron and a conduction electron can be approximated by an exponentially screened Coulomb potential. (auth)

4002

SIMULTANEITY IN THE COMPTON EFFECT. Z. Bay, V. P. Henri, and F. McLernon (George Washington Univ., Washington, D. C.). Phys. Rev. **97**, 1710-12(1955) Mar. 15.

The simultaneity in the Compton effect has been investigated by using scintillation counters and fast coincidence techniques. By the use of a gamma-ray source of a known, very short, lifetime (Ni^{60}) it was possible to apply a first moment investigation to the time delays involved. It is shown that the order of magnitude of all possible time delays involved in the Compton effect does not exceed 10^{-11} second. (auth)

4003

THEORY OF IONIZATION FLUCTUATIONS. J. E. Moyal (Univ. of Manchester). Phil. Mag. (7) **46**, 263-80(1955) Mar.

The distributions of the loss of energy by ionization of a fast primary and of the numbers of ion pairs it produces are derived. It is shown that down to quite small values of the primary ionization, both can be represented by the same universal distribution if the variables are reduced by a proper choice of scale and origin, which accounts for the experimental fact that ion pair numbers are proportional to primary energy loss. These conclusions remain valid when one takes into account quantum resonance effects and the details of atomic structure of the absorber. (auth)

4004

NEUTRON ATTENUATION MEASUREMENTS IN HEAVY AND LIGHT WATER AT ENERGIES BETWEEN 109 AND 169 MEV. R. Alphonse, A. Johansson, A. E. Taylor, and G. Tibell (Univ. of Uppsala, Sweden). Phil. Mag. (7) **46**, 295-9(1955) Mar.

The difference between the total cross section of deuterium and hydrogen has been obtained at effective energies of 109, 117, 132, 149 and 169 Mev from attenuation measurements on light and heavy water. Using published values of the hydrogen cross section, the oxygen total cross section was also obtained at these energies. (auth)

4005

THE ELASTIC SCATTERING OF PROTONS BY HELIUM 3. D. R. Sweetman (Univ. of Birmingham). Phil. Mag. (7) **46**, 358-60(1955) Mar.

The angular distribution for the elastic scattering of protons by He^3 has been determined. The internal He^3 beam of the Birmingham 10 in. cyclotron was used with a specially designed scattering chamber. Results are presented for 14.9 Mev He^3 ions scattered from protons, showing a pronounced minimum at 90° and a steep rise toward 180° . (M.P.G.)

4006

THEORIES OF PHOTONUCLEAR REACTIONS. J. S. Levinger (Louisiana State Univ., Baton Rouge). Ann. Rev. Nuclear Sci. **4**, 13-32(1954).

Several theories of photon absorption by nuclei are

reviewed. Experimental results for the interaction of moderate energy photons with medium to heavy nuclei are briefly considered. Material is presented on the photo-disintegration of the deuteron and other light nuclei. A major portion of the review is devoted to a comparison of γ absorption phenomena according to various nuclear models. (K.S.)

4007

POSITRONIUM. S. DeBenedetti and H. C. Corben (Carnegie Inst. of Tech., Pittsburgh). Ann. Rev. Nuclear Sci. **4**, 191-218(1954).

The theory of the annihilation process is first discussed followed by sections on the formation of positronium in gases (discovery, detection, and formation and decomposition), positron annihilation and positronium formation in condensed materials (momentum of annihilating pairs and mean lives of positrons in solids), and fine structure and Zeeman effect. 81 references. (L.M.T.)

4008

THE INTERACTIONS BETWEEN π -MESONS AND NUCLEONS. Murray Gell-Mann (Univ. of Chicago) and Kenneth M. Watson (Univ. of Wisconsin, Madison). Ann. Rev. Nuclear Sci. **4**, 219-70(1954).

The various theoretical concepts which have proved somewhat successful in simplifying the experimental data on pion-nucleon interactions are summarized. The model used is based on three assumptions: (a) the pion-nucleon interactions have a finite range, (b) charge independence is valid for these phenomena (i.e., I-spin is conserved), and (c) the state ($I = \frac{3}{2}$, $J = \frac{3}{2}$, $l = 1$) of the pion-nucleon system is one of especially strong ("attractive") interaction. 56 references. (L.M.T.)

4009

PENETRATION OF HEAVY CHARGED PARTICLES IN MATTER. Edwin A. Uehling (Univ. of Washington, Seattle). Ann. Rev. Nuclear Sci. **4**, 315-50(1954).

The penetration of heavy particles (heavier than electrons) is discussed primarily, with occasional references to experimental data involving light particles in order to supplement available data on heavy particles. Concern is not made primarily with range-energy data, although some are included and reference made to more complete lists of others. No attempt is made to cover the whole field of heavy-particle penetration, but only to treat the few special topics in which there appears to have been the greatest amount of recent interest. 89 references. (L.M.T.)

RADIATION EFFECTS

4010 KAPL-1307

Knolls Atomic Power Lab.

AN X-RAY STUDY OF THE EFFECTS OF INTENSE NEUTRON IRRADIATION ON THE STRUCTURE OF SOME GLASSES. J. S. Lukesh. Mar. 29, 1955. 17p. Contract W-31-109-Eng-52.

Detailed x-ray scattering curves have been obtained for four glasses subjected to intense neutron irradiation. No evidence indicating incipient devitrification was observed. (auth)

4011

EFFECTS OF NUCLEAR REACTOR EXPOSURE ON SOME PROPERTIES OF VITREOUS SILICA AND QUARTZ. W. Primak, L. H. Fuchs, and P. Day (Argonne National Lab.). J. Am. Ceram. Soc. **38**, 135-9(1955) Apr.

Changes in several physical properties of vitreous silica

and quartz due to ionization and atomic displacements initiated by pile radiations are reported. Annealing data are also reported. (C.W.H.)

4012

THE MECHANISM OF THE IRRADIATION DISORDERING OF ALLOYS. G. H. Kinchin and R. S. Pease (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 1, 200-2(1955) Feb.

An atom moving through a crystal as a result of a heavy particle collision may change places with a stationary atom. Calculations of the numbers of such replacements suggest that this mechanism may be responsible for the rapid disordering produced in ordered alloys by irradiation. (auth)

4013

CONDUCTIVITY INDUCED BY X-RAYS IN POLY-ETHYLENE TEREPHTHALATE. A POSSIBLE INSULATOR FOR RADIOLOGICAL APPARATUS. J. F. Fowler and F. T. Farmer (Royal Victoria Infirmary, Newcastle upon Tyne, England). *Nature* 175, 590-1(1955) Apr. 2.

The conductivity induced in polyethylene terephthalate by x radiation was studied as a function of temperature and dose rate. The decay of the induced current was noted. (C.W.H.)

4014

DISORDERING OF SOLIDS BY NEUTRON RADIATION. W. S. Snyder (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.) and Jacob Neufeld (Oak Ridge National Lab., Tenn.). *Phys. Rev.* 97, 1636-46(1955) Mar. 15.

A general method is outlined for determining the number of vacant lattice sites or interstitial atoms in a monatomic solid exposed to neutron radiation. The colliding atoms are assumed to be within the energy range for which the orbital picture can be applied. Following the treatment of Bohr, the scattering regions of excessive and moderate screening, Rutherford distribution, and electronic collisions are considered separately. The number of vacancies or interstitial atoms as a function of the energy of the primary knocked-out atom is given by the solution of certain integral equations that are different for various energy regions considered. It is found that if the velocity of a recoil atom resulting from neutron collision is less than e^2/\hbar (region of elastic collisions) approximately half of its energy is used up to produce vacancies or interstitials. If the velocity of the recoil atom is above e^2/\hbar (region of inelastic collisions) then the energy used up to produce vacancies and interstitials is approximately constant for medium and heavy elements. A simple formula has been derived expressing the average number of vacant lattice sites or interstitials produced in a collision of a neutron in a monatomic solid composed of medium or heavy elements. (auth)

RADIOACTIVITY**4015** AEC-tr-2112

MEASUREMENT OF THE BETA-ACTIVITY OF THICK SOURCES. Pierre Lerch. Translated from *Helv. Phys. Acta* 26, 663-90(1953). 39p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 8-1446.

4016

HALF-LIFE AND RADIATIONS OF THE LONG-LIVED ISOTOPE OF NIOBIUM (^{94}Nb). Mario A. Rollier, Einar Saeland, Armando Morpurgo, and Albertina Cagliaris (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). *Acta Chem. Scand.* 9, No. 1, 57-67(1955).

Solvent extraction of Nb by di-isopropyl ketone gave an efficient separation of the pile-irradiated metal from Ta. An Al-absorption curve gave a β energy of between 0.5 and 0.6 Mev. The gamma spectrum as determined by a scintillation spectrometer gave three energies: 0.73, 0.90, and 1.63 Mev. A half life based on β counting was determined as 1.77×10^4 yr ($\pm 25\%$). The short-lived 6.6 min Nb^{94m} beta activity was confirmed. (C.W.H.)

4017

A 3.8 SECOND ISOMER Au^{183m} . J. Brunner, H. Guhl, J. Halter, and O. Huber (Univ. of Fribourg, Zurich, Switzerland). *Helv. Phys. Acta* 28, 85-8(1955) Feb. (In German)

4018

GAMMA RAYS IN THE DECAY OF ^{112}Pd AND ^{112}Ag . R. H. Nussbaum, A. H. Wapstra, M. J. Sterk, and R. E. W. Kropveld (Instituut voor Kernphysisch Onderzoek, Amsterdam, Netherlands). *Physica* 21, 77-8(1955) Jan. (In English)

Additional spectral data are presented for Pd^{112} and Ag^{112} . For Pd^{112} a beta of 280 kev and a gamma of 18.5 kev are confirmed. A gamma spectrum of Ag^{112} is outlined. (C.W.H.)

4019

STANDARDIZATION OF RADIOACTIVE SOURCES. George G. Manov (U. S. Atomic Energy Commission, Washington, D. C.). *Ann. Rev. Nuclear Sci.* 4, 51-68(1954).

Problems associated with the preparation and certification of primary standards for β and β - γ emitters are reviewed. (K.S.)

4020

ALPHA RADIOACTIVITY. I. Perlman and Frank Asaro (Univ. of California, Berkeley). *Ann. Rev. Nuclear Sci.* 4, 157-90(1954).

This review is concerned with α -decay energy, complex α spectra, even-even α emitters, old nucleon α emitters, and α -decay of lifetimes and theory. 116 references. (L.T.W.)

4021

NOMOGRAM FOR RADIOISOTOPE BUILDUP AND DECAY. J. R. Stehn and E. F. Clancy (Knolls Atomic Power Lab., Schenectady, N. Y.). *Nucleonics* 13, No. 4, 27(1955) Apr.

Buildup or decay factors for a particular isotope can be read directly after placing a straight-edge at appropriate positions on the half life and time of decay or irradiation scales. (L.M.T.)

4022

CALCULATING HALF-LIFE FOR LOW ACTIVITIES OF SHORT-LIVED NUCLIDES. Paul T. Wagner (Mare Island Naval Shipyard, Vallejo, Calif.). *Nucleonics* 13, No. 4 54-6(1955) Apr.

A derivation is presented showing that by keeping the counting time constant, the half life can be determined from two independent counting periods, which may be widely separated. In addition, the half-life can also be obtained from the slope of a curve obtained by plotting the logarithm of total counts in constant counting periods against time recorded at the beginning of each counting period. Thus, one avoids the corrections necessary when determining half life by plotting the logarithm of the mean counting rate against the time recorded at the midpoint of the counting interval or Schuler's less direct approach based on a series equation. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS**4023**

THE HEAT OF COMBUSTION OF GADOLINIUM. Elmer J.

Huber, Jr. and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). *J. Am. Chem. Soc.* 77, 1444-5(1955) Mar. 20.

Calorimetric combustions of gadolinium metal were performed at an initial temperature of 24.6° under an oxygen pressure of 25 atm. The energy of combustion under these conditions was found to be 5773 ± 12 Joules/g. The corresponding standard heat of formation of the sesquioxide (B-type) from the elements is calculated to be -1815.6 ± 3.6 kJoules/mole. No literature values are available for comparison. (auth)

4024

ANALYSIS OF THE ARC SPECTRUM OF LUTETIUM.

P. F. A. Klinkenberg (Zeeman-Laboratorium der Universiteit, Amsterdam, Netherlands). *Physica* 21, 53-62(1955) Jan. (In English)

The arc spectrum of the last rare earth element, lutetium, has been analyzed. The most important electron configurations in Lu I have been identified, and practically all strong lines have been classified. A list of levels (51) and a table of all classified lines (124) are given. The ionization potential is found to be 6.15 volts. (auth)

THEORETICAL PHYSICS

4025 UCRL-4433

Radiation Lab., Univ. of Calif., Livermore

CHARGED PARTICLE PRESSURE IN ELECTROMAGNETIC FIELDS. Louis R. Henrich. Dec. 23, 1954. 20p. Contract W-7405-eng-48.

The stress energy tensor for matter and the electromagnetic field are derived. The conservation equations are then expressed by setting the divergence of this tensor equal to zero. It is found under certain conditions that the particle pressure plus the energy density in the electromagnetic field does not vary along a particular coordinate. However, this sum is not constant in the general case. (auth)

4026

THEORY OF MULTIPLE PRODUCTION OF PARTICLES AT HIGH ENERGIES. S. Z. Belen'ki (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* 28, 111-13(1955) Jan. (In Russian)

4027

THE FERMI THEORY OF MULTIPLE PRODUCTION OF PARTICLES IN NUCLEON COLLISIONS. I. L. Rosenthal (Lebedev Physics Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* 28, 118-20(1955) Jan.

4028

PHASE TRANSITIONS OF THE SECOND ORDER IN BOSE GAS. Yu. B. Rumer. *Doklady Akad. Nauk S.S.R.* 100, 887-8(1955) Feb. 11. (In Russian)

4029

ON THE PROBLEM OF INTRODUCTION OF DYNAMIC VARIABLES IN THE QUANTUM THEORY OF FIELDS. B. M. Stepanov. *Doklady Akad. Nauk S.S.R.* 100, 889-92(1955) Feb. 11. (In Russian)

4030

ON THE PROBLEM OF INTERACTION OF TWO QUANTIZED FIELDS. E. S. Fradkin (Lebedev Physics Inst.). *Doklady Akad. Nauk S.S.R.* 100, 897-900(1955) Feb. 11. (In Russian)

4031

THE CONTRIBUTION OF NON-STATIC FORCES TO THE

BINDING-ENERGY OF THE DEUTERON. Frans Cerulus. *Helv. Phys. Acta* 28, 67-84(1955) Feb. (In English)

The Bethe-Salpeter equation for the bound states of a neutron and a proton, having a scalar interaction with a charged meson field, is set up. Keeping the binding energy fixed the eigenvalue for the coupling constant g is determined, taking into account the g^2 and the g^4 terms in the equation. This is done by means of a perturbation method, starting from the static approximation, and showing that the non-static forces contribute an important part to the binding. For a 2.18-Mev binding energy there results $g^2 = 0.54 g_0^2$ where g_0 is the value obtained from the static approximation. (auth)

TRITIUM AND TRITIUM COMPOUNDS

4032

ONE-TO-TWO MILLIMETER WAVE SPECTRA OF TCI AND TBr. Charles A. Burrus and Walter Gordy (Duke Univ., Durham, N. C.) and Ben Benjamin and Ralph Livingston (Oak Ridge National Lab., Tenn.). *Phys. Rev.* 97, 1661-4(1955) Mar. 15.

The $J = 0 \rightarrow 1$ rotational transitions of TCl and TBr have been measured at 1.36 mm and 1.74 mm wavelengths, respectively. Characteristic constants obtained were the unperturbed rotational frequencies, nuclear quadrupole couplings, zero point vibration effects, equilibrium vibration effects, and internuclear distances. From the TBr measurements and similar measurements on DBr made previously, the mass ratio m_t / m_d was obtained. (C.W.H.)

URANIUM AND URANIUM COMPOUNDS

4033

SUPERCONDUCTIVITY OF URANIUM. John E. Kilpatrick, Edward F. Hammel, and Dillon Mapother (Los Alamos Scientific Lab., N. Mex.). *Phys. Rev.* 97, 1634-5(1955) Mar. 15.

Superconductivity has been found in three samples of uranium. The transition is broad (0.2 to 0.3°K wide), and is centered at 0.77°K for two samples and at 0.80°K for the third. (auth)

4034

THE THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF URANIUM. V. O. Eriksen and W. Hälg (Brown Boveri & Co., Ltd., Baden, Switzerland). *J. Nuclear Energy* 1, 232-3(1955) Feb.

A plot of heat conductivity λ , resistivity ρ , and the constant $\lambda \cdot \rho / T$ for annealed U for temperatures up to 830°C is given. (L.M.T.)

4035

THE ELECTRONIC STRUCTURE AND MAGNETIC PROPERTIES OF URANYL-LIKE IONS. I. URANYL AND NEPTUNYL. J. C. Eisenstein and M. H. L. Pryce (Clarendon Lab., Oxford, England). *Proc. Roy. Soc. (London)* A229, 20-38(1955) Apr. 5.

A theory of the electronic bonding in the uranyl ion is given, on the basis of which the paramagnetism of uranyl can be explained. Assuming the same bonding mechanism to be effective in neptunyl, with one unpaired electron, its energy levels, absorption spectrum, paramagnetic resonance and susceptibility are discussed. Agreement with experiment is satisfactory. The evidence points clearly to f -electrons being responsible for the magnetism. (auth)

